No. 58

THE STUDY
ON
THE PROMOTION OF TOTAL QUALITY CONTROL
IN
SMALL AND MEDIUM SCALE INDUSTRIES
AND CERTIFICATION SYSTEM
FOR
INDUSTRIAL EXPORT PRODUCTS IN THE ARGENTINE REPUBLIC

Vol. II

NOVEMBER 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

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APPENDIX

1. Enquetes

Marquese con un TILDE las respuestas correspondientes y enviarla a la Sede del Consejo Coordinador - Uruguay 705 (1053) - CAPITAL FEDERAL.

1- ESCALA DE EMPRESAS

(1) Empleados

a : Menos de 30
b : De 31 a 100
c : de 101 a 200
d : de 201 a 300
e : mas de 301

(2) Fundacion de la empresa

a : Menos de 5 años
b : de 6 a 10 años
c : de 11 a 20 años
d : de 21 a 30 años
e : mas de 30 años

(3) Produccion en el año 1980 (En U$S)

a : Menos de 100.000
b : de 100.001 a 1.000.000
c : de 1.000.001 a 5.000.000
d : mas de 5.000.001

(4) Entrega a las terminales

a : Cia. AUTOLATINA
b : Cia. SEVEL
c : Cia. RENAULT
d : Otros

(5) Tiene la empresa asociacion tipo Joint-Venture con alguna empresa extranjera?

a : No tenemos asociacion
b : Tenemos asociacion con una empresa americana
c : Tenemos asociacion con una empresa europea
d : Tenemos asociacion con una empresa de otro pais

2- ESTRATEGIA DE LA EMPRESA

(1) Piensan Uds. aumentar le produccion ampliando la escala de su empresa en un futuro cercano?

a : Si
b : No
c : Indecision

(2) Cual es el punto debil en el caso en que se expandiera la empresa?

a : Capital
b : Materia prima
c : Personal
d : Instalaciones
e : Explotacion de la red de venta

(3) Piensan Uds. realizar la exportacion con la colaboracion de la politica de fomento a la exportacion de piezas de automotores por parte del Gobierno ?

a : Si
b : No

(4) Cual es el punto debil en el caso de que vuestra empresa exportara sus propios productos o en el caso de que se incrementara el porcentaje de la exportacion ?

a : Capital
b : Materia Prima
c : Personal
d : Instalaciones
e : Poder competitivo
f : Explotacion del mercado

3- LA SECRETARIA DE INDUSTRIA Y COMERCIO EXTERIOR ESTA ACTUALMENTE INTENTANDO IMPLEMENTAR EL PROGRAMA DE FOMENTO PARA LA INTRODUCCION DEL CONTROL DE CALIDAD Y DEL SISTEMA DE ACREDITACION DE ENTIDADES DE CERTIFICACION PARA INCREMENTAR LA EXPORTACION DE AUTOPARTES.

(1) Estan Uds. de acuerdo con este plan de fomento del control de calidad ?

a : Si
b : No
c : De acuerdo con las condiciones

(2) Estan Uds. de acuerdo con este plan de fomento del sistema de la certificacion de productos industriales de exportacion?

a : Si
b : No
c : De acuerdo con las condiciones

4- PODRIAN UDS. CONTESTARNOS SOBRE EL ESTADO ACTUAL DE SUS PROYECTOS Y ESPECTATIVAS PARA EL FUTURO, CON RESPECTO AL CONTROL DE CALIDAD DE VUESTRA EMPRESA.

(1) Cual es el sistema del control de calidad que se lleva a cabo actualmente en vuestra empresa ?

a : Inspeccion total
b : Inspeccion por muestreo
c : SQC - Control estadistico
d : TQC - Gestion total de calidad

(2) Cual es la referencia que Uds. toman en el caso de que se realice la inpeccion por muestreo en vuestra empresa ?

a : Especificacion MIL
b : Especificacion ISO
c : Otros

(3) Cual es el objetivo mas importante que tienen Uds.en cuenta cuando se realiza el control de calidad en vuestra empresa ?

a : Mejoramiennto de la calidad y estabilidad
b : Reduccion de costos
c : Cumplimiento de entrega
d : Otros.

(4) Quien lleva a cabo el control de calidad en vuestra empresa ?

a : Una seccion de control de calidad independiente
b : Un grupo de la seccion de produccion
c : Un grupo de la seccion del control de produccion
d : Consignacion a un instituto externo

5) En el caso que se produjeran productos defectuosos en vuestra empresa, cual es la seccion que se ocupa de evitar que este problema ocurra nuevamente ?

a : Seccion de control de calidad
b : Seccion de produccion
c : Comite de calidad
d : Clientes

(6) Los principales fabricantes de las piezas de automotores de Japon han obtenido actualmente exito al haber introducido el sistema de calidad a la forma japonesa. Piensan Uds. que seria favorable introducir este sistema de calidad japones, inclusive Circulos de Control de Calidad (CCC) en vuestra empresa ?

a : Si
b : Deseariamos introducirlo si hubiera apoyo de parte del gobierno, etc.
c : No

(7) Cual es el punto debil en el caso de que se introdujera al control de calidad segun el sistema japones (Incluyendo los CCC)

a : Consentimiento del sindicato
b : Escasez de personal especializado
c : Entendimiento de los administradores

5- SOBRE LAS EXIGENCIAS Y RELACION DE LOS CLIENTES (EMPRESAS AUTOMOTRICES) HACIA VUESTRA EMPRESA.

(1) Cual es actualmente la mayor exigencia que Uds. notan hacia vuestra empresa, de parte de las empresas automotrices, en cuanto a los productos que Uds. fabrican ?

a : Estabilizacion de calidad
b : Estabilizacion de precios
c : Cumplimiento de entrega

(2) Que es lo que se considera mas eficaz en cuanto a la politica de vuestra empresa para satisfacer los puntos arriba mencionados ?

a : Estabilizacion de la materia prima
b : Elevacion de la moral de los empleados
c : Innovacion de las instalaciones o tecnologias

(3) Cual es la relacion actual de Uds. con respecto a las empresas automotrices de la que constituyen su fuente de abastecimiento.

a : Grupo del mismo capital
b : Relacion comercial simple
c : Alianza tecnica
d : Abastecimiento de materia prima

(4) Cual es el tipo de asistencia que reciben Uds. desde las empresas automotrices de las que constituyen su fuente de abastecimiento ?

a : Capital
b : Tecnologia
c : Personal
d : Instalaciones, etc.

5) Realizan actualmente Uds. reuniones en forma periodica con las empresas automotrices?

a : Frecuentemente
b : A veces
c : Raramente
d : Ninguna

Cual es el tema que se trata en estas reuniones?

e : Entrega
f : Precio
g : Calidad
h : Administracion de los fondos

6- DEMANDA PARA LLEVAR A CABO LA EXPANSION DE VUESTRA EMPRESA Y FOMENTAR A LA VEZ LA EXPORTACION.

1) Cual es el punto que se considera mas importante, teniendo en cuenta la exportacion de los productos de vuestra empresa?

a : Control de calidad
b : Procuramiento de la materia prima
c : Modernizacion de las instalaciones
d : Mejoramiento de la tecnologia
e : Procuramiento del capital de operacion
f : Procuramiento de personal.

2) Que es lo que esperarian Uds. como una medida preferencial del gobierno argentino en cuanto a considerar la exportacion de los productos de vuestra empresa?

a : Asistencia de capital
b : Medidas preferenciales del sistema impositivo
c : Asistencia de desarrollo y de investigacion

3) Piensan Uds. elevar el poder competitivo por medio de la automatizacion de la fabrica en las instalaciones de produccion?

a : Si
b : No
c : Indecision

4) Que clase de asistencia necesitarian Uds. con respecto a los puntos que hemos mencionado arriba?

a : Asistencia del capital
b : Medida preferencial del sistema impositivo
c : Asistencia de desarrollo y de investigacion

5) Piensan Uds. fabricar productos nuevos contando con la alianza tecnica de un pais extranjeero en el caso que las condiciones fueran aptas para Uds.?

a : Si
b : No
c : Indecision

6) Piensan Uds. realizar la capacitacion tecnica del personal en Japon o se realizaria la capacitacion tecnica si existiera un con-

tro de capacitacion tecnica del gobierno argentino, con el fin de interiorizarse del sistema del control de calidad?

a : Si
b : No
c : Si, si hubiera asistencia

7) Piensan Uds. recibir las instrucciones de los expertos japoneses de TQC durante un periodo determinado si las condiciones fueran aptas para Uds.?

a : Si
b : No
c : Indecision

8) Cuentan Uds. con computadoras (incluyendo las computadoras personales) en vuestra empresa?

a : Si
b : No

9) Cuales serian las secciones para la introduccion de las computadoras (para refuerzo) en el futuro?

a : Diseño
b : Calculo del costo de la fabrica
c : Control de la produccion
d : Otros

10) Que lugares considerarian Uds. posibles como mercado de sus productos, en el caso de que pudieran obtener el poder competitivo para realizar la exportacion?

a : Brasil
b : Mejico
c : Otros paises de centro y Sudamerica
d : Norteamerica
e : Europa
f : Asia
g : Africa

11) Existen dos metodos para elevar la productividad, es decir, un metodo es reforzar las instalaciones y los equipos y el otro metodo es reforzar la produccion por medio de subcontratistas, en este caso, cual seria la preferencia de Uds. o por cual se resolverian?

a : Reforzar las instalaciones y equipos de la empresa
b : Reforzar la produccion por medio de subcontratistas
c : Se tomaria el metodo mas ventajoso para el calculo del costo de fabricacion.

LES AGRADECEMOS PROFUNDAMENTE LA COLABORACION DE UDS.

2. Results of the Enquetes upon simple addition

< 1-1 Employees > ... (S A)

1)	c-1 30orless	23	(20.4)
2)	c-2 3 1 − 1 0 0	45	(39.8)
3)	c-3 1 0 1 − 2 0 0	30	(26.5)
4)	c-4 2 0 1 − 3 0 0	8	(7.1)
5)	c-5 301or above	7	(6.2)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	113	(100.0)

< 1-2 Foundation > ... (S A)

1)	C-1 5 年 year or less	3	(2.7)
2)	C-2 6 — yrs.	5	(4.4)
3)	C-3 1 1 yrs.	14	(12.4)
4)	C-4 2 1 yrs.	41	(36.3)
5)	C-5 3 0 yrs.or above	50	(44.2)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	113	(100.0)

< 1-3 Production in 1988 > ... (S A)

1)	C-1 100,000 $ or less	14	(12.4)	12.6
2)	C-2 100,001-1,000,000 F$	39	(34.5)	35.1
3)	C-3 1,000,001-5,000,000 $	42	(37.2)	37.8
4)	C-4 5,000,001 $ or above	16	(14.2)	14.4
	Unknown	2	(1.8)	
	Not applicable	0	(0.0)	
	Total	113	(100.0)	111

< 1-4 Delivered to: > ... (M A)

1)	C-1 Autoratina	64	(56.6)	64.0
2)	C-2 Cebel	56	(49.6)	56.0
3)	C-3 Renault	55	(48.7)	55.0
4)	C-4 Others	78	(69.0)	78.0
	Unknown	13	(11.5)	
	Not applicable	0	(0.0)	
	Total	113	(100.0)	100

< 1-5 J.V. w/Foreign Co. or not > ... (S A)

1)	C-1 Not	97	(85.8)	89.8
2)	C-2 J.V.w/US Co.	4	(3.5)	3.7
3)	C-3 "w/European Co.	5	(4.4)	4.6
4)	C-4 " w/Co. of other area	2	(1.8)	1.9
	Unknown	5	(4.4)	
	Not applicable	0	(0.0)	
	Total	113	(100.0)	108

< 2-1 Any expansion plan? > ... (S A)

1)	C-1 Yes	77	(68.1)
2)	C-2 No	14	(12.4)
3)	C-3 Not decided yet	22	(19.5)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	113	(100.0)

< 2-2 Necks for expansion > ... (M A)

1)	C-1 Fund	52	(46.0)	48.6
2)	C-2 Materials	4	(3.5)	3.7
3)	C-3 Staff	9	(8.0)	8.4
4)	C-4 Equipment	27	(23.9)	25.2
5)	C-5 Sales promotion	38	(33.6)	35.5
	Unknown	6	(5.3)	
	Not applicable	0	(0.0)	
	Total	113	(100.0)	107

< 2-3 Cooperation to Export Promotion of Auto parts> .. (S A)

1)	C-1 Yes	83	(73.5)	79.0
2)	C-2 No	22	(19.5)	21.0
	Unknown	8	(7.1)	
	Not applicable	0	(0.0)	
	Total	113	(100.0)	105

< 2-4 Necks when exporting products > ... (M A)

1)	C-1 Fund	40	(35.4)	38.1
2)	C-2 Materials	6	(5.3)	5.7
3)	C-3 Staff	7	(6.2)	6.7
4)	C-4 Equipments	24	(21.2)	22.9
5)	C-5 Competitive power	37	(32.7)	35.2
6)	C-6 Market development	38	(33.6)	36.2
	Unknown	8	(7.1)	
	Not applicable	0	(0.0)	
	Total	113	(100.0)	105

< 3-1 Yes or No for QC promotion plan >.. (S A)

1)	C-1 Yes	91	(80.5)
2)	C-2 No	0	(0.0)
3)	C-3 Conditional Yes.	22	(19.5)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	113	(100.0)

< 3-2 Yes or No for certification system >.(S A)

1)	C-1 Yes	87	(77.0)	77.7
2)	C-2 No	1	(0.9)	0.9
3)	C-3 Conditional Yes.	24	(21.2)	21.4
	Unknown	1	(0.9)	
	Not applicable	0	(0.0)	
	Total	113	(100.0)	112

< 4-1 Applicable QC > ... (M A)

1)	Total checking	35	(31.0)	31.5
2)	Sampling checking	57	(50.4)	51.4
3)	Standard for sampling checking	31	(27.4)	27.9
4)	Others	22	(19.5)	19.8
	Unknown	2	(1.8)	
	Not applicable	0	(0.0)	
	Total	113	(100.0)	111

< 4-2 Standards for sampling test > . . (M A)

1)	C-1 MIL Spec	14	(12.4)	20.6
2)	C-2 ISO Spec	14	(12.4)	20.6
3)	C-3 Others	50	(44.2)	73.5
	Unknown	45	(39.8)	
	Not applicable	0	(0.0)	
	Total	113	(100.0)	68

< 4-3 Target of QC > ... (M A)

1)	C-1 Improvement/steadiness of quality	100	(88.5)	90.9
2)	C-2 Cost down	38	(33.6)	34.5
3)	C-3 Secured delivery	24	(21.2)	21.8
4)	C-4 Others	3	(2.7)	2.7
	Unknown	3	(2.7)	
	Not applicable	0	(0.0)	
	Total	113	(100.0)	110

< 4-4 Structure for QC. > ... (S A)

1)	C-1 Independent Dept. exclusive for QC.	82	(72.6)
2)	C-2 An unit for Mfg.	22	(19.5)
3)	C-3 An unit for Prod. Control Dept.	6	(5.3)
4)	C-4 Assignment to an outside institution	3	(2.7)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	113	(100.0)

< 4-5 Checking Sect. for poor quality products > .. (M A)

1)	C-1 QC Dept.	48	(42.5)
2)	C-2 Mfg. Dept.	61	(54.0)
3)	C-3 QC Committee	34	(30.1)
4)	C-4 Clients	2	(1.8)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	113	(100.0)

6-1 Points to be enforced when exporting products ... (M A)

1)	C-1 QC.	58	(51.3)	53.2
2)	C-2 Securing materials	18	(15.9)	16.5
3)	C-3 Modernization of facilities	27	(23.9)	24.8
4)	C-4 Technology improvement	39	(34.5)	35.8
5)	C-5 Securing operational funds	40	(35.4)	36.7
6)	C-6 " staff	7	(6.2)	6.4
	Unknown	4	(3.5)	
	Not applicable	0	(0.0)	
	Total	113	(100.0)	109

< 6-2 Preferential steps expected/ for Govt. > ... (M A)

1)	C-1 Fund support	39	(34.5)	37.9
2)	C-2 Tax benefit	57	(50.4)	55.3
3)	C-3 R/D support	31	(27.4)	30.1
	Unknown	10	(8.8)	
	Not applicable	0	(0.0)	
	Total	113	(100.0)	103

< 6-3 FA made of Mfg. facilities > ... (S A)

1)	C-1 Yes	73	(64.6)
2)	C-2 No	9	(8.0)
3)	C-3 Can't say Yes or No.	31	(27.4)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	113	(100.0)

< 6-4 *Supporting methods for the above*> ... (M A)

1)	C-1 Fund support	55	(48.7)	51.9
2)	C-2 Tax benefit	50	(44.2)	47.2
3)	C-3 R/D support	32	(28.3)	30.2
	Unknown	7	(6.2)	
	Not applicable	0	(0.0)	
	Total	113	(100.0)	106

< 6-5 New products made by technical/ cooperation w/overseas > ... (S A)

1)	C-1 Yes	91	(80.5)
2)	C-2 No	9	(8.0)
3)	C-3 Can't say Yes or No.	13	(11.5)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	113	(100.0)

< 6-6 Necessity for training QC methods>. (S A)

1)	C-1 Yes	33	(29.2)	30.0
2)	C-2 No	6	(5.3)	5.5
3)	C-3 If supported, Yes.	71	(62.8)	64.5
	Unknown	3	(2.7)	
	Not applicable	0	(0.0)	
	Total	113	(100.0)	110

< 6-7 Necessity of guidance by TQC experts > ... (S A)

1)	C-1 Yes	97	(85.8)	88.2
2)	C-2 No	5	(4.4)	4.5
3)	C-3 Can't say Yes or No.	8	(7.1)	7.3
	Unknown	3	(2.7)	
	Not applicable	0	(0.0)	
	Total	113	(100.0)	110

< 6-8 Have or have not a computer > ... (S A)

1)	C-1 Yes	93	(82.3)
2)	C-2 No	20	(17.7)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	113	(100.0)

< 6-9 Introduction plan of computers> ... (M A)

1)	C-1 Architechture	30	(26. 5)	28. 3
2)	C-2 Cost accounting	49	(43. 4)	46. 2
3)	C-3 Production control	71	(62. 8)	67. 0
4)	C-4 Others	29	(25. 7)	27. 4
	Unknown	7	(6. 2)	
	Not applicable	0	(0. 0)	
	Total	113	(100. 0)	106

< 6-10Market target when export is feasible > ... (M A)

1)	C-1 Brasil	66	(58. 4)	60. 6
2)	C-2 Mexico	57	(50. 4)	52. 3
3)	C-3 Other,Central & South America	71	(62. 8)	65. 1
4)	C-4 North America	75	(66. 4)	68. 8
5)	C-5 Europe	65	(57. 5)	59. 6
6)	C-6 Asia	40	(35. 4)	36. 7
7)	C-7 Africa	61	(54. 0)	56. 0
	Unknown	4	(3. 5)	
	Not applicable	0	(0. 0)	
	Total	113	(100. 0)	109

< 6-11 Methods for larger production > ... (S A)

1)	C-1 Enforcement of equipments	46	(40. 7)	41. 8
2)	C-2 Enforcement of outside orders	8	(7. 1)	7. 3
3)	C-3 Methods advantageous for cost accounting	56	(49. 6)	50. 9
	Unknown	3	(2. 7)	
	Not applicable	0	(0. 0)	
	Total	113	(100. 0)	110

3. Results of the Enquetes upon crosa addition

6-5 New products by foreign technical cooperation (SA)

Relation w/5-3 Clients /Total/ C-1 Yes/C-2 No/Can't say Yes or No.
applicable
... (MA)
Unknown/Not applicable

* Total *	113 100.0	91 80.5	9 8.0	13 11.5	- -	- -
C-1 Capital group	1 100.0	1 100.0	- -	- -	- -	- -
C-2 Just business relation	92 100.0	73 79.3	9 9.8	10 10.9	- -	- -
C-3 Technical cooperation	5 100.0	5 100.0	- -	- -	- -	- -
C-4 Material supply	6 100.0	5 83.3	- -	1 16.7	- -	- -
(Unknown)	16 100.0	13 81.3	- -	3 18.8	- -	- -
(Not applicable)	- -	- -	- -	- -	- -	- -

2-3 Cooperation for export promotion of auto parts - - - (SA)

2-1 Business expansion program . (SA)	*Total*	C-1 Yes	C-2 No	Unknown	Not applicable
Total	113 100.0	83 79.0	22 21.0	8 -	- -
C-1 Yes	77 100.0	54 77.1	16 22.9	7 -	- -
C-2 No	14 100.0	10 76.9	3 23.1	1 -	- -
C-3 Can't say Yes or No	22 100.0	19 86.4	3 13.6	- -	- -
(Unknown)	- -	- -	- -	- -	- -
(Not applicable)	- -	- -	- -	- -	- -

<6-3 To make Mfg. Equipment FA style - - - (SA)

2-1 Business Expansion Program (SA)	*Total*	C-1 Yes	C-2 No	C-3 Can't say Yes or No	Unknown	Not applicable
* *Total* *	113	73	9	31	-	-
	100.0	64.6	8.0	27.4	-	-
C-1 Yes	77	59	4	14	-	-
	100.0	76.6	5.2	18.2	-	-
C-2 No	14	7	3	4	-	-
	100.0	50.0	21.4	28.6	-	-
C-3 Can't say Yes or No	22	7	2	13	-	-
	100.0	31.8	9.1	59.1	-	-
(Unknown)	-	-	-	-	-	-
	-	-	-	-	-	-
(Not applicable)	-	-	-	-	-	-
	-	-	-	-	-	-

6-10 Market target when export is feasible - - - (MA)

2-3 Plans for export promotion of auto parts ... (SA)	Total	C-1 Brasil	C-1/C-2 Mexico	C-3 Other C./S. America	C-4 N.America	C-5 Europe	C-6 Asia	C-7 Africa	Unknown	Not applicable
* *Total* *	113	66	57	71	75	65	40	61	4	-
	100.0	60.6	52.3	65.1	68.8	59.6	36.7	56.0	-	-
C-1 Yes	83	53	40	53	60	53	31	49	1	-
	100.0	64.6	48.8	64.6	73.2	64.6	37.8	59.8	-	-
C-2 No	22	10	13	12	11	9	3	5	2	-
	100.0	50.0	65.0	60.0	55.0	45.0	15.0	30.0	-	-
Unknown	8	3	4	6	4	3	6	6	1	-
	100.0	42.9	57.1	85.7	57.1	42.9	85.7	85.7	-	-
Not applicable	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-

6-11 Methods for prod. expansion - - - (SA)

2-1 Business Exp. Plans ... (SA)	*Total*	C-1 Fac.Exp.	C-2 Sales Prom.	/C-3 - Advantageous for cost acc.	Unknown	Not applicable
Total *	113	46	8	56	3	-
	100.0	41.8	7.3	50.9	-	-
C-1 Yes	77	34	4	37	2	-
	100.0	45.3	5.3	49.3	-	-
C-2 No	14	5	3	6	-	-
	100.0	35.7	21.4	42.9	-	-
C-3 Can't say Yes or No	22	7	1	13	1	-
	100.0	33.3	4.8	61.9	-	-
(Unknown)	-	-	-	-	-	-
	-	-	-	-	-	-
(Not applicable)	-	-	-	-	-	-
	-	-	-	-	-	-

6-8 Have/haven't a computer - - - (SA)

2-2 Necks for bus. exp. ... (MA)	*Total*	C-1 Yes	C-2 No	Unknown/Not applicable	
* *Total* *	113	93	20	-	-
	100.0	82.3	17.7	-	-
C-1 Fund.	52	40	12	-	-
	100.0	76.9	23.1	-	-
C-2 Materials	4	3	1	-	-
	100.0	75.0	25.0	-	-
C-3 Staff	9	9	-	-	-
	100.0	100.0	-	-	-
C-4 Equipments	27	22	5	-	-
	100.0	81.5	18.5	-	-
C-5 Sales Prom	38	32	6	-	-
	100.0	84.2	15.8	-	-
(Unknown)	6	5	1	-	-
	100.0	83.3	16.7	-	-
(Not applicable)	-	-	-	-	-
	-	-	-	-	-

<< 5-4 Support from clients >> ... (MA)

2-2 Necks for bus. exp. ... (MA)	*Total*	C-1 Fund.	C-2 Materials	C-3 Staff	C-4 Equipments	Unknown/Not applicable	
Total *	113	2	36	7	1	68	-
	100.0	4.4	80.0	15.6	2.2	-	-
C-1 Fund.	52	1	17	5	-	29	-
	100.0	4.3	73.9	21.7	-	-	-
C-2 Materials	4	-	1	1	-	2	-
	100.0	-	50.0	50.0	-	-	-
C-3 Staff	9	1	3	-	-	5	-
	100.0	25.0	75.0	-	-	-	-
C-4 Equipments	27	-	9	-	-	18	-
	100.0	-	100.0	-	-	-	-
C-5 Sales Prom.	38	-	12	4	-	22	-
	100.0	-	75.0	25.0	-	-	-
(Unknown)	6	-	2	1	1	3	-
	100.0	-	66.7	33.3	33.3	-	-
(Not applicable)	-	-	-	-	-	-	-
	-	-	-	-	-	-	-

<< 5-5 Regular meetings w/clients - - - (SA) SA)

2-2 Necks bus.exp. ... (MA)	*Total*	C-1 Often	C-2 Occasionally	C-3 Once in a while	C-4 Never	Unknown/Not applicable	
Total *	113 100.0	45 46.4	28 28.9	19 19.6	5 5.2	16 -	- -
C-1 Fund	52 100.0	18 39.1	17 37.0	8 17.4	3 6.5	6 -	- -
C-2 Materials	4 100.0	2 50.0	1 25.0	1 25.0	- -	- -	- -
C-3 Staff	9 100.0	3 37.5	1 12.5	4 50.0	- -	1 -	- -
C-4 Equipments	27 100.0	12 60.0	6 30.0	2 10.0	- -	7 -	- -
C-5 Sales prom.	38 100.0	13 38.2	9 26.5	10 29.4	2 5.9	4 -	- -
(Unknown)	6 100.0	5 83.3	- -	1 16.7	- -	- -	- -
(Not applicable)	- -	- -	- -	- -	- -	- -	- -

<< 6-2 Preferentials expected from Gov't .. (MA)

6-1 Strengthening pts. when exporting prod. ... (MA)	*Total*	C-1 Fund support	C-2 Tax benefit	C-3 R/D support	Unknown/Not applicable	
Total *	113 100.0	39 37.8	57 55.3	31 30.1	10 -	- -
C-1 QC	58 100.0	18 34.0	28 52.8	21 39.6	5 -	- -
C-2 Securing Materials	18 100.0	6 37.5	11 68.8	2 12.5	2 -	- -
C-3 Modernization of equip.	27 100.0	10 40.0	13 52.0	10 40.0	2 -	- -
C-4 Technical Imp.	39 100.0	15 40.5	18 48.6	17 45.9	2 -	- -
C-5 Securing operational funds	40 00.0	24 68.6	17 48.6	7 20.0	5 -	- -
C-6 Securing stuff	7 100.0	- -	4 66.7	3 50.0	1 -	- -
(Unknown)	4 100.0	- -	1 100.0	- -	3 -	- -
(Not applicable)	- -	- -	- -	- -	- -	- -

6-9 Introduction schedule of computers - - - (MA)· · (MA)

2-2 Necks for ⊘ bus. exp. ... (MA)	*Total*	C-1 Design	C-2 Cost Acc.	C-3 Prod. Cont.	C-4 Others	Unknown	Not applicable
* *Total* *	113 100.0	30 28.3	49 46.2	71 67.0	29 27.4	7 -	- -
C-1 Fund	52 100.0	16 32.7	26 53.1	29 59.2	16 32.7	3 -	- -
C-2 Mateerials	4 100.0	1 25.0	2 50.0	3 75.0	1 25.0	- -	- -
C-3 Stuff	9 100.0	2 25.0	3 37.5	7 87.5	- -	1 -	- -
C-4 Equipments	27 100.0	7 26.9	14 53.8	18 69.2	8 30.8	1 -	- -
C-5 Sales Prom.	38 100.0	7 20.6	16 47.1	27 79.4	9 26.5	4 -	- -
(Unknown)	6 100.0	2 33.3	- -	4 66.7	4 66.7	- -	- -
(Not applicable)	- -	- -	- -	- -	- -	- -	- -

<< 4-1 Applicable QC >> ... (MA)

3-1 Yes or No for QC prom. plan ... (SA)	*Total*	C-1 Total check	C-2 Sampling check	C-3 SQC	C-4 TQC	Unknown/	Not applicable
*Total *	113 100.0	35 31.5	57 51.4	31 27.9	22 19.8	2 -	- -
C-1 Yes	91 100.0	31 34.4	45 50.0	25 27.8	18 20.0	1 -	- -
C-2 No	- -	- -	- -	- -	- -	- -	- -
C-3 Conditional Yes	22 100.0	4 19.0	12 57.1	6 28.6	4 19.0	1 -	- -
(Unknown)	- -	- -	- -	- -	- -	- -	- -
(Not applicable)	- -	- -	- -	- -	- -	- -	- -

<< 4-4 Organisation for QC >> ... (SA)

Yes or No for QC promotion plan(SA)	Total	C-1 Ind.Dept. excl. for Q C	C-2 An Org. for Mfg.	C-3 An Org. for prod. cont.	C-4 Ent. to an outside inst.	Unknown	Not applicable
* Total *	113 100.0	82 72.6	22 19.5	6 5.3	3 2.7	- -	- -
C-1 Yes	91 100.0	69 75.8	17 18.7	3 3.3	2 2.2	- -	- -
C-2 No	- -	- -	- -	- -	- -	- -	- -
C-3 Conditional Yes	22 100.0	13 59.1	5 22.7	3 13.6	1 4.5	- -	- -
(Unknown)	- -	- -	- -	- -	- -	- -	- -
(Not applicable)	- -	- -	- -	- -	- -	- -	- -

4-6 Introduction plan of Japanese like OC >> ... (SA)

4-I Applicable QC ... (MA)	*Total*	C-1 Yes	C-2 If aided by Gov't,etc.	C-3 None	Unknown	Not applicable
Total	113 100.0	65 65.7	31 31.3	3 3.0	14 -	- -
C-I Total check	35 100.0	23 71.9	8 25.0	1 3.1	3 -	- -
C-2 Sampling check	57 100.0	28 58.3	18 37.5	2 4.2	9 -	- -
C-3 SQC	31 100.0	24 82.8	4 13.8	1 3.4	2 -	- -
C-4 TQC	22 100.0	15 75.0	5 25.0	- -	2 -	- -
(Unknown)	2 100.0	1 100.0	- -	- -	1 -	- -
(Not applicable)	- -	- -	- -	- -	- -	- -

4-6 Intro. plan Jap.like QC >> ... (SA)

4-4 Org. for QC(SA) ... (SA)	*Total*	C-1 Yes	C-2 If aided by Gov't, etc.	C-3 None	Unknown	Not applicable
Total *	113 100.0	65 65.7	31 31.3	3 3.0	14 -	- -
C-1 Ind.Div. exclusive for QC	82 100.0	54 70.1	22 28.6	1 1.3	5 -	- -
C-2 A unit for Mfg.Div.	22 100.0	8 50.0	7 43.8	1 6.3	6 -	- -
C-3 A unit for Prod. Cont.	6 100.0	1 25.0	2 50.0	1 25.0	2 -	- -
C-4 Entrusted to an outside inst.	3 100.0	2 100.0	- -	- -	1 -	- -
(Unknown)	- -	- -	- -	- -	- -	- -
(Not applicable)	- -	- -	- -	- -	- -	- -

6-6 Necessity for training of QC methods - - - (SA))

4-6 Intro.plan of Jap. like QC ... (SA)	*Total*	C-1 Yes	C-2 No	C-3 If aided, Yes.	Unknown	Not applicable
Total	113 100.0	33 30.0	6 5.5	71 64.5	3 -	- -
C-1 Yes	65 100.0	26 41.3	2 3.2	35 55.6	2 -	- -
C-2 If aided by Gov't, etc.	31 100.0	4 13.3	2 6.7	24 80.0	1 -	- -
C-3 None	3 100.0	- -	- -	3 100.0	- -	- -
(Unknown)	14 100.0	3 21.4	2 14.3	9 64.3	- -	- -
(Not applicable)	- -	- -	- -	- -	- -	- -

6-7 Necessity for leadership by TQC experts - - - (SA))

4-6 Intro.plan for Jap.type QC ... (SA)	*Total*	C-1 Yes	C-2 No	C-3 Can't say Yes or No	Unknown	Not applicable
Total	113 100.0	97 88.2	5 4.5	8 7.3	3 -	- -
C-1 Yes	65 100.0	62 96.9	- -	2 3.1	1 -	- -
C-2 If aided by Gov't etc.	31 100.0	27 87.1	2 6.5	2 6.5	- -	- -
C-3 None	3 100.0	1 33.3	1 33.3	1 33.3	- -	- -
(Unknown)	14 100.0	7 58.3	2 16.7	3 25.0	2 -	- -
(Not applicable)	- -	- -	- -	- -	- -	- -

<< 5-1 Clients' requests for you >> ... (MA)

4-3 QC target ... (MA)	*Total*	C-1 Steady quality	C-2 Steady price	C-3 Strict delivery date	Unknown	Not applicable
Total	113 100.0	34 34.7	79 80.6	34 34.7	15 -	- -
C-1 Steady quality prom.	100 100.0	29 33.0	71 80.7	31 35.2	12 -	- -
C-2 Cost down	38 100.0	13 40.6	26 81.3	15 46.9	6 -	- -
C-3 Strict delivery date	24 100.0	10 50.0	17 85.0	12 60.0	4 -	- -
C-4 Others	3 100.0	2 66.7	3 100.0	2 66.7	- -	- -
(Unknown)	3 100.0	2 66.7	2 66.7	2 66.7	- -	- -
(Not applicable)	- -	- -	- -	- -	- -	- -

4-5 Div. finding cause for poor quality products . (MA)

4-4 Org for QC(SA) for QC ... (SA)	*Total*	C-1 QC Div.	C-2 Mfg.Div	C-3 QC Committee	C-4 Clients	Unknown	Not applicable
Total	113	48	61	34	2	-	-
	100.0	42.5	54.0	30.1	1.8	-	-
C-1 Ind.Div exclusive for QC	82	40	39	29	-	-	-
	100.0	48.8	47.6	35.4	-	-	-
C-2 A unit for Mfg.Div.	22	2	19	3	2	-	-
	100.0	9.1	86.4	13.6	9.1	-	-
C-3 A unit Prod.Cont.Div.	6	3	3	2	-	-	-
	100.0	50.0	50.0	33.3	-	-	-
C-4 Entrusted to an outside inst.	3	3	-	-	-	-	-
	100.0	100.0	-	-	-	-	-
(Unknown)	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
(Not applicable)	-	-	-	-	-	-	-
	-	-	-	-	-	-	-

4-7 Necks for intro.Jap.type QC - - - (MA) >> ... (MA)

4-4 Org. for QC ... (SA)	*Total*	C-1 Union's	C-2 Shortage of expert staff	C-3 Mgmt's under standing	Unkown	Not applicable
**Total* *	113	21	56	20	27	-
	100.0	24.4	65.1	23.3	-	-
C-1 Ind.Div.excl. for QC	82	19	43	15	14	-
	100.0	27.9	63.2	22.1	-	-
C-2 A unit for Mfg.Div.	22	1	11	4	7	-
	100.0	6.7	73.3	26.7	-	-
C-3 A unit for od. Prod.Cont.Div.	6	-	1	1	4	-
	100.0	-	50.0	50.0	-	-
C-4 Ent. to an outside inst.	3	1	1	-	2	-
	100.0	100.0	100.0	-	-	-
(Unknown)	-	-	-	-	-	-
	-	-	-	-	-	-
(Not applicable)	-	-	-	-	-	-
	-	-	-	-	-	-

5-2 In-office steps for clients' demands - >> ... (MA)

2-2 Necks for Bus.Exp ... (MA)	*Total*	Steady Mat.	C-2 Morale up of employees	C-3 Renovation of equip.	Unknown	Not applicable
Total	113 100.0	49 50.5	25 25.8	46 47.4	16 -	- -
C-1 Fund	52 100.0	24 52.2	11 23.9	24 52.2	6 -	- -
C-2 Materialr	4 100.0	3 75.0	- -	1 25.0	- -	- -
C-3 Staff	9 100.0	4 50.0	4 50.0	2 25.0	1 -	- -
C-4 Equip.	27 100.0	9 45.0	6 30.0	13 65.0	7 -	- -
C-5 Sales Prom.	38 100.0	13 38.2	10 29.4	21 61.8	4 -	- -
(Unknown)	6 100.0	5 83.3	2 33.3	1 16.7	- -	- -
(Not applicable)	- -	- -	- -	- -	- -	- -

5-3 Relation w/clients - - - (MA) >> ... (MA)

1-5 JV w/Foreign Cos. ... (SA)	*Total*	C-1 Cap.Group	C-2 Just Bus. Rel.	C-3 Tech.Coop.	C-4 Mat.Supply	Unknown	Not applicable
Total	113 100.0	1 1.0	92 94.8	5 5.2	6 6.2	16 -	- -
C-1 Not a JV.	97 100.0	- -	79 94.0	4 4.8	4 4.8	13 -	- -
C-2 JV w/US Co.	4 100.0	1 25.0	4 100.0	- -	1 25.0	- -	- -
C-3 JV w/Europ Co.	5 100.0	- -	5 100.0	1 20.0	- -	- -	- -
C-4 JV w/Other Co.	2 100.0	- -	2 100.0	- -	- -	- -	- -
(Unknown)	5 100.0	- -	2 100.0	- -	1 50.0	3 -	- -
(Not applicable)	- -	- -	- -	- -	- -	- -	- -

4. Checklist for plant inspection

1. Acceptance control

(1) Is an acceptance inspection carried out?

(2) Have standards for acceptance inspection been established?

(3) What is the rate of defective parts subcontracted parts (below 5%)?

(4) Is any instruction given to subcontractors?

(5) Is the same quality control on purchased materials also performed?

2. inventory control

(1) Inventories of Raw materials (within one month)

(2) " Sub-contracted parts (within one week)

(3) " Intermediate products (within one week)

(4) " Finished products (within a few days)

(5) Is finished products delivered within a few days?

(6) Are goods in a factory tidily placed?

(7) Is the area (passage, working area) secured?

(8) Are stocks managed by computers?

3. Machines/Facilities

(1) Are workers assigned only to particular machines (workers to be versatile in different work)?

(2) Is an automation device introduced?

(3) Is regular inspection and maintenance of machined executed?

(4) Are jigs and fixtures well prepared (to be enough for work at site)?

(5) Are measuring instruments well prepared (to be enough for work at site)?

(6) Are testing equipment well prepared (to be enough for work at site)?

(7) Are die casts replaced efficiently?

(8) Are die casts well maintained?

4. Work at site/manufacturing process?

(1) Are working standard/instructions prepared?
(2) Is worker education/training provided?
(3) Are defective parts left in working area?
(4) Are goods in process left in working area?
(5) Are die casts/jigs and fixtures replaced efficiencly?
(6) Is sufficient space (passage, working area) is provided?
(7) Are flow charts for manufacturing process prepared?
(8) Is a flow production line introduced in the machining process?
(9) Is layout of plant efficiently arranged?
(10) Is there any measure to manufacture wide range of products in small quantities?
(Preparation of parts to be assembled, standardization of design, reducing time to set up the production line, auto feeding system)
(11) Have modifications of plant layout been made to meet operating conditions?
(12) Have the arrangements and accommodation of machines and tools been defined in an appropriate manner?
(13) Can goods in process and defective parts be clearly distinguished from each other?
(14) Is safety well taken into consideration?

5. Design Technics

(1) Is a design technic self-developed?
(2) Is a design technic of jigs and fixtures self-developed?
(3) Is a design technic of instruments for inspection self-developed?
(4) Is a design technic of measuring instruments be self-developed?
(5) Are drawings tidily maintained and managed?
(6) Is production done under certain design standards?
(7) Has standardization of die casts design been established?
(8) Is products development carried out with assemblers?

6. Quality control

(1) Are defective parts fed to the next process stage?
(2) Is there any dedicated department for quality control?
(3) Does the activity of the quality control department contribute to improvements in quality?
(4) Does personnel in charge of quality control communicate with other sections?
(5) Have standard specification for inspection been prepared?
(6) Is production of defective parts promptly recognized/detected by supervisors?
(7) Is final inspection a hundred percent test?
(8) Does inspection function only as a means of selection of defective parts?
(9) Are any fool proof system, jigs and fixtures well prepared?
(10) Are records/details of defective parts kept?
(11) Are data on defects fed back?
(12) Is occurance of defects displayed in a factory?
(13) Is any facility to verify quality assurance provided?
(14) Is work for quality assurance performed?

This checklist was prepared based on the quality control system finally considered desirable for the current auto-parts industry, after surveying the facts of Argentina's auto-parts industry on site and through repeated reviews. The checklist is divided into 6 sections: acceptance control, inventory control, machines/facilities, work at site/manufacturing process, design technic and quality control, and further sub-items to be checked are provided for each of the main items.

Attached to this paper are the results of the plant inspection carried out at 20 companies manufacturing mechanical parts and 20 companies manufacturing electro-mechanical parts for automobiles, respectively.

A: Accentance Control

B: Machinery/Equipment

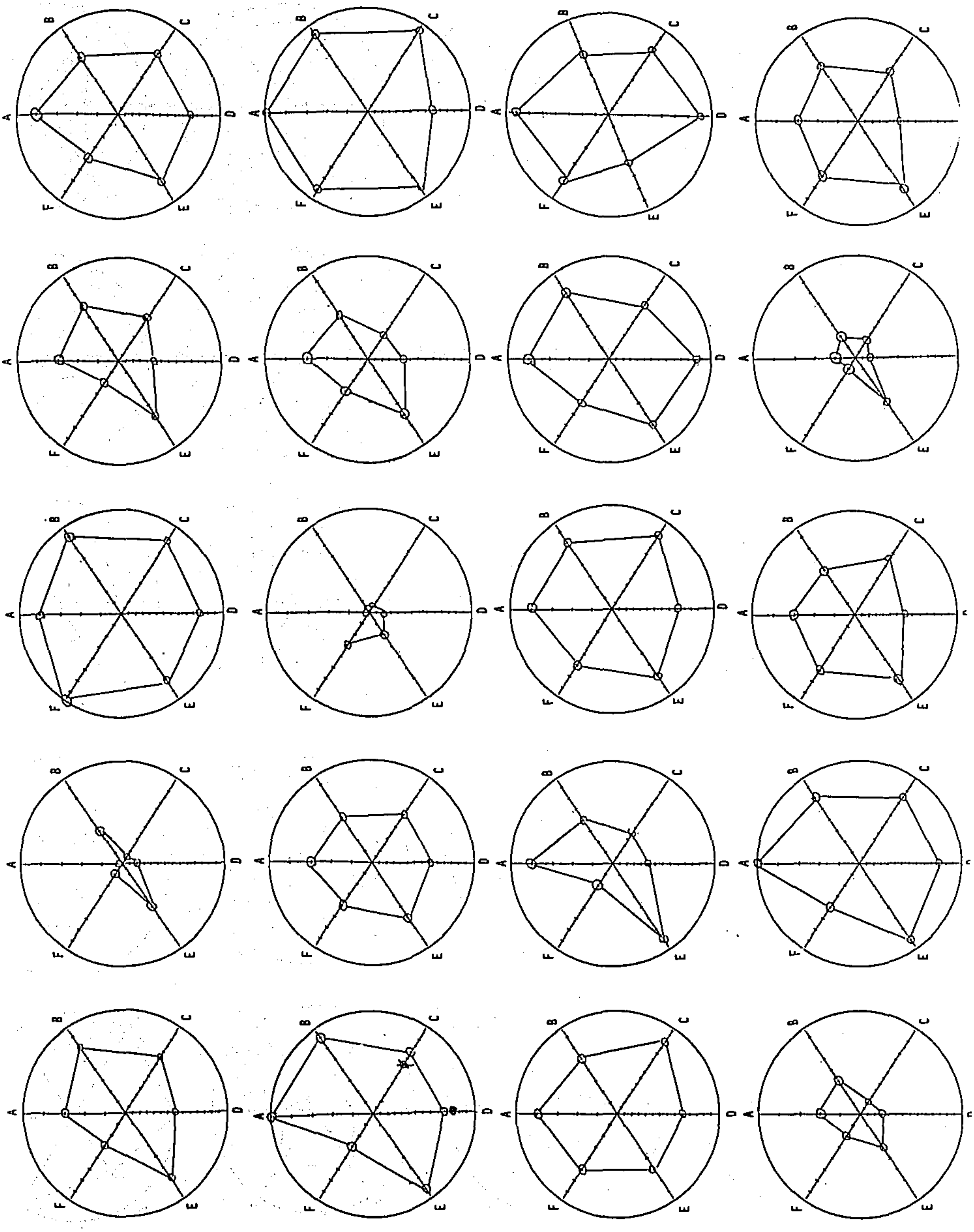
C: Quality Control (QC)

D: Site Works/Production Process

E: Design Technics

F: Inventory Control

Results of Plant Diagnosis (1): 20 Machinery Parts Companies



Results of Plant Diagnosis (2): 20 Electrical Equipment Companies

A: Accentance Control

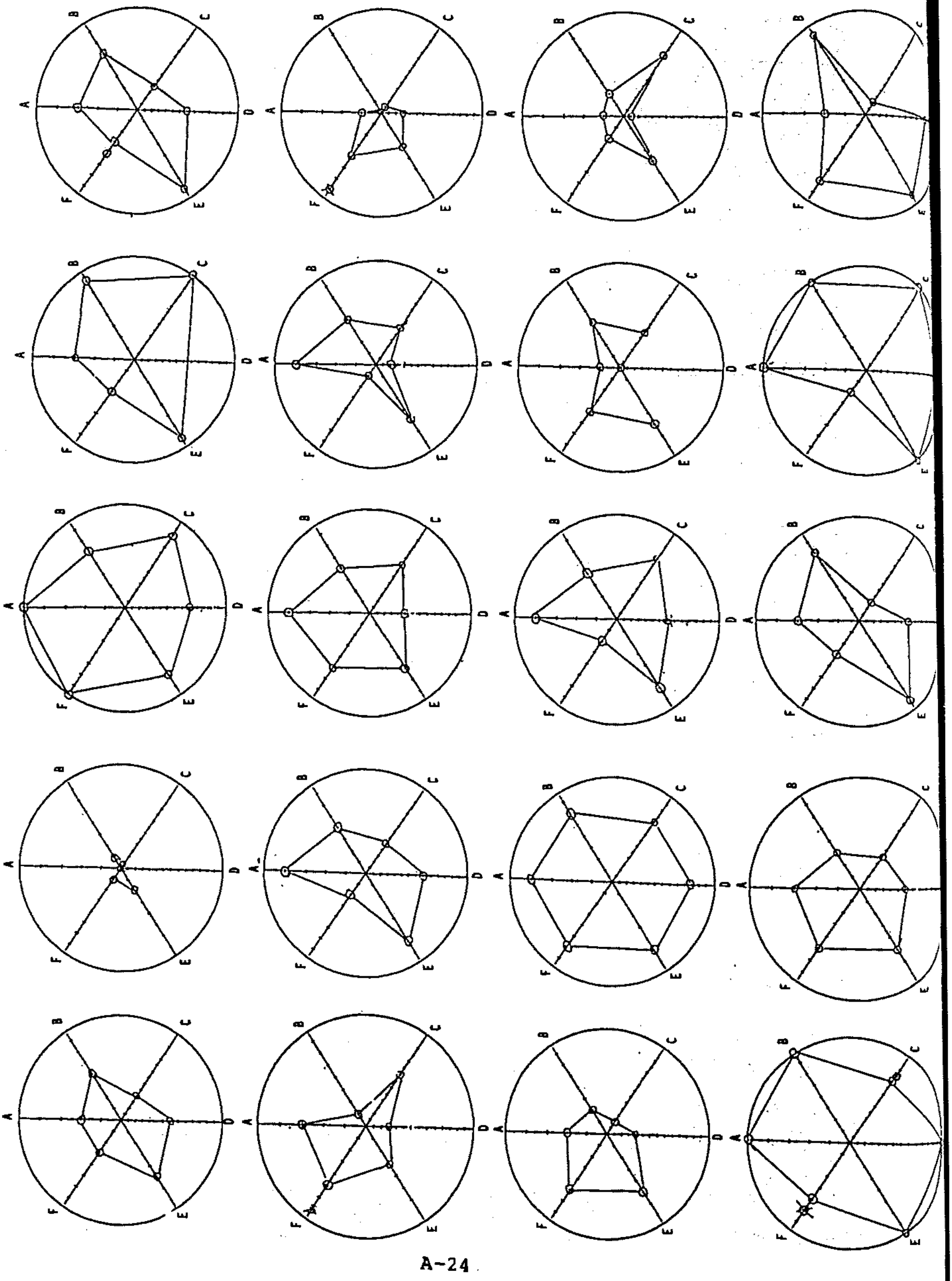
B: Machinery/Equipment

C: Quality Control (QC)

D: Site Works/Production Proc

E: Design Technics

F: Inventory Control



5. Results of analysis on the checklist

< (1-1 Acceptance > ... (S A)

1)	C-1 Good	33	(82.5)
2)	C-2 No good	7	(17.5)
	unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

<1-2 Making an Acceptance Standard > ... (S A)

1)	C-1 Good	22	(55.0)
2)	C-2 No good	18	(45.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

< 1-3 5%orless of poor quality goods ordered outside - - - (SA)

1)	C-1 Good	31	(77.5)	79.5
2)	C-2 No good	8	(20.0)	20.5
	Unknown	1	(2.5)	
	Not applicable	0	(0.0)	
	Total	40	(100.0)	39

< 1-4 Guidance for outside suppliers > ... (S A)

1)	C-1 Good	11	(27.5)	28.2
2)	C-2 No Good	28	(70.0)	71.8
	Unknown	1	(2.5)	
	Not applicable	0	(0.0)	
	Total	40	(100.0)	39

< 1-5 QC for purchased materials - - - (SA) S A)

1)	C-1 Good	26	(65.0)
2)	C-2 No good	14	(35.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

< 2-1 Amt. of Material Inventory/within a month - - - (SA)

1)	C-1 Good	15	(37.5)
2)	C-2 No good	25	(62.5)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

< 2-2 Amt. of Parts ordered from outside/within a week - - - (SA)

1)	C-1 Good	12	(30.0)	35.3
2)	C-2 No good	22	(55.0)	64.7
	Unknown	6	(15.0)	
	Not applicable	0	(0.0)	
	Total	40	(100.0)	34

< 2-3 Semi-finished goods inventory/within a week - - - (SA)

1)	C-1 Good	12	(30.0)
2)	C-2 No good	28	(70.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

< 2-4 Inventory of finished goods/within 2-3 ds.

1)	C-1 Good	12	(30.0)
2)	C-2 No Good	28	(70.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

<2-5 Does delivery of finished goods made right away? - - (SA)

1)	C-1 Good	15	(37.5)	38.5
2)	C-2 No good	24	(60.0)	61.5
	Unknown	1	(2.5)	
	Not applicable	0	(0.0)	
	Total	40	(100.0)	39

2-6 Securing a space for placing goods - - - (SA))

1)	C-1 Good	32	(80.0)
2)	C-2 No good	8	(20.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

2-7 Securing a passway/work space - - - (SA) . (S A)

1)	C-1 Good	38	(95.0)
2)	C-2 No good	2	(5.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

2-8 Computer control of inventories - - - (SA) (S A)

1)	C-1 Good	16	(40.0)	42.1
2)	C-2 No good	22	(55.0)	67.9
	Unknown	2	(5.0)	
	Not applicable	0	(0.0)	
	Total	40	(100.0)	38

3-1 Workersare not exclusive for the machine - - - (SA,

1)	C-1 Good	7	(17.5)
2)	C-2 No good	33	(82.5)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

3-2 Efficiency derived from automation of mechanical processing - - - (SA)

1)	C-1 Good	17	(42.5)	43.6
2)	C-2 No good	22	(55.0)	56.4
	Unknown	1	(2.5)	
	Not applicable	0	(0.0)	
	Total	40	(100.0)	39

3-3 Inspection & maintenance of machinery - - - (SA))

1)	C-1 Good	34	(85.0)	87.2
2)	C-2 No good	5	(12.5)	12.8
	Unknown	1	(2.5)	
	Not applicable	0	(0.0)	
	Total	40	(100.0)	39

<3-4 Installation of jigs & tools - - - (SA) ...(S A)

1)	C-1 Good	33	(82.5)
2)	C-2 No good	7	(17.6)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

<3-5 Installation of measuring machines - - - (SA)(S A)

1)	C-1 Good	34	(85.0)
2)	C-2 No good	6	(15.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

<3-6 Installation of testing machines - - - (SA) (S A)

1)	C-1 Good	28	(70.0)
2)	C-2 No good	12	(30.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

<3-7 Devices for replacing molds - - -(SA) ...(S A)

1)	C-1 Good	4	(10.0)	11.4
2)	C-2 No good	31	(77.5)	88.6
	Unknown	5	(12.5)	
	Not applicable	0	(0.0)	
	Total	40	(100.0)	35

<3-8 Custody of molds - - - (SA) > ...(S A)

1)	C-1 Good	25	(62.5)	69.4
2)	C-2 No good	11	(27.5)	30.6
	Unknown	4	(10.0)	
	Not applicable	0	(0.0)	
	Total	40	(100.0)	36

<4-1 Preparing standards & manuals for works - - - (SA)

1)	C-1 Good	29	(72.5)
2)	C-2 No good	11	(27.5)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

<4-2 work education & training for workers - - - (SA))

1)	C-1 Good	20	(50.0)
2)	C-2 No good	20	(50.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

<4-3 No poor quality goods at sites - - - (SA) ..(S A)

1)	C-1 Good	29	(72.5)
2)	C-2 No good	11	(27.5)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

< 4-4 No work in process is left on site > ...(S A)

1)	C-1 Good	12	(30.0)
2)	C-2 No good	28	(70.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

< 4-5 Least replacing time of molds & jigs/tools - - - (SA)

1)	C-1 Good	13	(32.5)	36.1
2)	C-2 No good	23	(57.5)	63.9
	Unknown	4	(10.0)	
	Not applicable	0	(0.0)	
	Total	40	(100.0)	36

<4-6 Securing passages/work spaces at site - - - (SA)

1)	C-1 Good	36	(90.0)
2)	C-2 No good	4	(10.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

<4-7 Making of a flow chart for work processes - - - (SA)

1)	C-1 Good	14	(35.0)
2)	C-2 No good	26	(65.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

<4-8 Assembly lines among mechanical processings - - - (SA)

1)	C-1 Good	7	(17.5)	17.9
2)	C-2 No good	32	(80.0)	82.1
	Unknown	1	(2.5)	
	Not applicable	0	(0.0)	
	Total	40	(100.0)	39

4-9 Layout inside a plant - - - (SA) > ... (S A)

1) C-1 Good	19	(47.5)	48.7
2) C-2 No good	20	(50.0)	51.3
Unknown	1	(2.5)	
Not applicable	0	(0.0)	
Total	40	(100.0)	39

4-10 Steps for many kinds small amt. production - - - (SA)

1) C-1 Good	11	(27.5)
2) C-2 No good	29	(72.5)
Unknown	0	(0.0)
Not applicable	0	(0.0)
Total	40	(100.0)

4-11 Layout improvement according to working rates - - - (SA)

1) C-1 Good	9	(22.5)	23.1
2) C-2 No good	30	(75.0)	76.9
Unknown	1	(2.5)	
Not applicable	0	(0.0)	
Total	40	(100.0)	39

4-12 Clarifying orderly storage of fixtures/tools - - - (SA)

1) C-1 Good	29	(72.5)
2) C-2 No good	11	(27.5)
Unknown	0	(0.0)
Not applicable	0	(0.0)
Total	40	(100.0)

4-13 Discrimination of works in process & poor quality goods - - - (SA)

1) C-1 Good	26	(65.0)
2) C-2 No good	14	(35.0)
Unknown	0	(0.0)
Not applicable	0	(0.0)
Total	40	(100.0)

4-14 Arrangements for safety - - - (SA) > ... (S A)

1) C-1 Good	21	(52.5)	53.8
2) C-2 No good	18	(45.0)	46.2
Unknown	1	(2.5)	
Not applicable	0	(0.0)	
Total	40	(100.0)	39

5-1 In-office design of products is feasible - - - (SA)

1) C-1 Good	39	(97.5)
2) C-2 No good	1	(2.5)
Unknown	0	(0.0)
Not applicable	0	(0.0)
Total	40	(100.0)

5-2 In-office design & making of jigs/tools - - - (SA)

1) C-1 Good	37	(92.5)
2) C-2 No good	3	(7.5)
Unknown	0	(0.0)
Not applicable	0	(0.0)
Total	40	(100.0)

5-3 In-office Making of Testing Tools - - - (SA) S A)

1) C-1 Good	32	(80.0)
2) C-2 No good	8	(20.0)
Unknown	0	(0.0)
Not applicable	0	(0.0)
Total	40	(100.0)

5-4 In-office making of measuring tools - - - (SA) (S A)

1) C-1 Good	19	(47.5)
2) C-2 No good	21	(52.5)
Unknown	0	(0.0)
Not applicable	0	(0.0)
Total	40	(100.0)

5-5 Storage/control of drawings - - - (SA) ... (S A)

1)	C-1 Good	35	(87.5)	94.6
2)	C-2 No good	2	(5.0)	5.4
	Unknown	3	(7.5)	
	Not applicable	0	(0.0)	
	Total	40	(100.0)	37

5-6 Making based on design standards - - - (SA) S A)

1)	C-1 Good	32	(80.0)
2)	C-2 No good	8	(20.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

5-7 Standardisation of mold design - - - (SA) .. (S A)

1)	C-1 Good	10	(25.0)	27.8
2)	C-2 No good	26	(65.0)	72.2
	Unknown	4	(10.0)	
	Not applicable	0	(0.0)	
	Total	40	(100.0)	36

5-8 Product development jointly with associated companies - - - (SA)

1)	C-1 Good	18	(45.0)	46.2
2)	C-2 No good	21	(52.5)	53.8
	Unknown	1	(2.5)	
	Not applicable	0	(0.0)	
	Total	40	(100.0)	39

6-1 Inspection prevents carrying over of poor goods to the next process - (SA)

1)	C-1 Good	19	(47.5)
2)	C-2 No good	21	(52.5)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

6-2 any QC organization - - - (SA) > ... (S A)

1)	C-1 Good	33	(82.5)
2)	C-2 No good	7	(17.5)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

6-3 Dedication of QC org. to works - - (SA) > ... (S A)

1)	C-1 Good	20	(50.0)
2)	C-2 No good	20	(50.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

6-4 Sectional interchange of staff in charge of QC- - - (SA)

1)	C-1 Good	12	(30.0)
2)	C-2 No good	28	(70.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

6-5 Preparing a standard inspection manual - - - (SA)

1)	C-1 Good	28	(70.0)
2)	C-2 No good	12	(30.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

6-6 Reporting to a supervisor when a poor products is made - - - (SA)

1)	C-1 Good	16	(40.0)
2)	C-2 No good	24	(60.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

6-7 Is the final inspection aimed for the total? - - - (SA)

1)	C-1 Good	34	(85.0)
2)	C-2 No good	5	(15.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

6-8 Is inspections not good for discriminating poor goods - - - (SA)

1)	C-1 Good	16	(40.0)
2)	C-2 No good	24	(60.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

6-9 Preparing prevention of careless misses & work jigs - - - (SA)

1)	C-1 Good	5	(12.5)
2)	C-2 No good	35	(87.5)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

6-10 Recording of finding of poor goods/its contents - - - (SA)

1)	C-1 Good	26	(65.0)
2)	C-2 No good	14	(35.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

6-11 Feed backs for poor quality goods - - - (SA)

1)	C-1 Good	16	(40.0)
2)	C-2 No good	24	(60.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

6-12 Indication of status causing poor quality goods - - -(SA)

1)	C-1 Good	8	(20.0)
2)	C-2 No good	32	(80.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

6-13 Facilities for confirming QC - - - (SA)

1)	C-1 Good	27	(67.5)
2)	C-2 No good	13	(32.5)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

6-14 Works needed for QC - - - (SA)

1)	C-1 Good	28	(70.0)
2)	C-2 No good	12	(30.0)
	Unknown	0	(0.0)
	Not applicable	0	(0.0)
	Total	40	(100.0)

EXAMPLE 1 - REDUCING DEFECTS IN ELECTRIC CIRCUITS

1. Preface

We have an 8 mm cinecamera assembling line. The most critical areas of an 8 mm cinecamera are: 1) film feed, 2) focus, and 3) exposure.

The exposure device, also referred to as the shutter, is a device designed to control the amount of light. When we usually make pictures, we use an EE mechanism (this is an automatic exposure device).

As shown in Fig. 1, we have a cds after the shutter spring in our cameras. This means that the amount of light (luminosity) that falls onto the film is measured with this cds device. The cds feeds the measured luminosity back to the shutter spring through an amplifier so that any increases or decreases in the amount of light falling onto the film can be compensated by adjusting the shutter aperture to keep the incident light intensity constant. This regulating (cds) device needs a very large amount of electrical components.

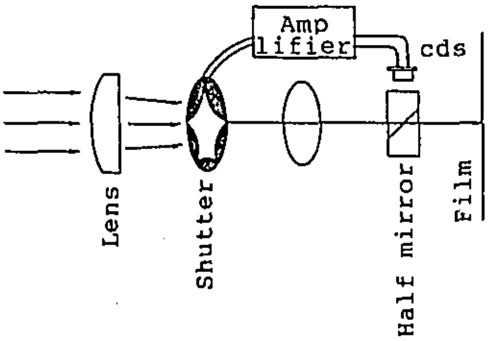


Fig. 1 EE Device Schematic Lens

2. Current Status of Defects and Setting of the Targets

We examined the situation in terms of defects as they occurred in the past to find out more details about operating problems with the exposure meter. As shown in the Pareto Chart of Fig. 2, the solder defects handled by the group members account for the majority of the defects. At a group meeting, it was decided that the set targets should be a reduction in the incidence of wiring errors and solder defects in connection with the exposure meter. At present, we have about 30 or more defects a week, which makes it 5 defects or so a day, and we set as our target a reduction of this defect incidence to a third, that is, to about 10 a week or 1.7 a day.

3. Cause and Effect Chart and Countermeasures

Since the defects concerned occur within the process flow, we in our group have the fear that our knowledge tended all too easily to be too one-sided and turn only around our own work. To acquire a greater latitude in our process knowledge, we began by studying the construction of the camera from the basics, namely by shooting pictures with the 8mm cinecamera assembled by ourselves.

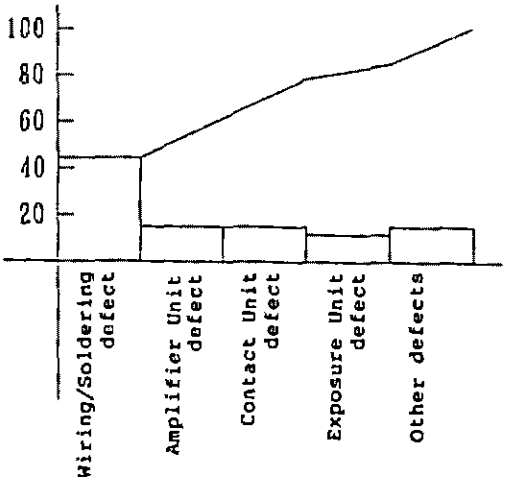
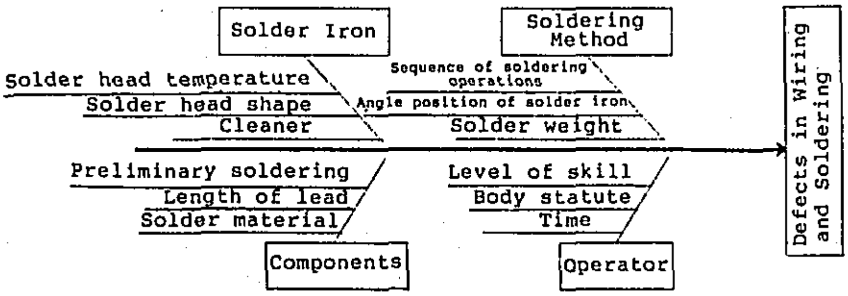


Fig. 2 Pareto Chart by Nature of Exposure Meter Defect

To learn also the operations performed by others, all group members actually carried out, one by one, the operational tasks of others to study the work methods.

After the acquisition of such knowledge about cameras and about the operations performed by the group members, a meeting took place in which all members participated to establish a Cause and Effect Chart.

Cause and Effect Diagram for Wiring and Soldering Operations



Defects in wiring and soldering are determined by four factors: solder iron, soldering method, component, and operator. We examined the problems, one by one, on the basis of a Cause and Effect Diagram. This formed the groundwork for the formulation of countermeasures to be introduced.

Let us begin with the cause given first: Solder Iron

(1) The temperature of the solder iron heat (tip) was measured over a period of several days, and no abnormal temperatures were discovered.

(2) An 8mm cinecamera has only a few soldering points and, what is more, they are extremely tightly spaced with other soldering points at a distance of only about 1mm. If a broad solder iron is used, there will be a real danger that the adjacent solder-ing location will melt. If a finely pointed solder iron is used, the problem will be that heat conduc-tion is very poor so that it takes a long time to solder. So the solder iron illustrated in Fig. 3 is adopted.

(3) A cleaner sponge which is used to keep a temperature of solder iron tip constant, is sometimes dry and

dirty. In either case, it is not possible to achieve a clean solder. For this reason, we decided to soak the cleaner sponge with water twice a day, once in the morning and the second time at midday to bring the temperature at the solder iron tip to the right level for a clean and perfect solder.

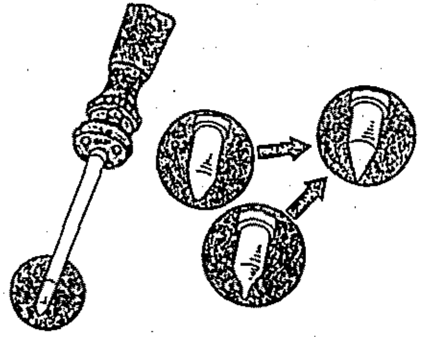


Fig. 3 Solder Iron Head

Let us now turn to the second cause: Soldering Method

(1) There was no problem so long as the soldering operation was performed in the correct order.

(2) We also examined the problems of solder pools, but the results showed that there was no problem.

(3) The angle at which the solder iron is applied to the work has so far not been regulated due to reasons associated with the solder iron shape. A particular shape of solder iron had been newly defined so that the matter could be examined. As a result, it was decided to take a solder iron angle position of around 45 degrees as standard since this was found to be the optimum angle giving the highest efficiency and the lowest incidence of defects. This was generally introduced and all members were properly trained to solder in this angle position.

Let us next turn to the third problem area: The Components

(1) In the case of printed circuit boards and leads, it is practice to pre-solder. The way the lead wire ends are finished is subject to some variation. Since 0.08 dia. x 13-stranded twisted leads are used, the leads become loose and it is difficult to solder them together so that the solder easily comes undone. This has led us to decide to contact the Inspection Section to look into the problem of finishing the lead ends and finding the right solution.

(2) The lead length presents no particular problem.

(3) Nor does the solder material present a particular problem. We thus decided to reexamine the continuity of purchase of products with the same standards from our present manufacturers.

Let us discuss the fourth problem area: The Operator

(1) The causes of defects discussed so far can all be gotten under control to a certain extent through the skill of the operator. So there was no particular problem here either. To deepen the understanding of the operation, group meetings were organized to study and learn the correct soldering procedure with the solder material.

(2) The operator's condition has been left up to the individual to decide in connection with his personal state of health. In really bad cases, however, the superior was informed.

(3) There was no problem with belt pitch timing for any of the operators.

The activities taken on the basis of the Cause and Effect Diagram had a clear effect in reducing defects.

However, the incidence of defects went up as the white lead of the EE switch came off. We examined the cause.

In the previous operation, the white lead had been soldered. But this is moved in the process so that it is understandable that it can break off. To make sure that the lead is not moved, we fastened it with tape. By taping it we were able to reduce the number of defects as had been expected. We were thus able to achieve the target in about two and a half months after we had started our activities.

One of the operators in the group was replaced by a new person as part of a new line arrangement. This new person was not used to the job so that there was again an increase in the number of defects.

When we examined the causes, we found that as there is a large number of leads on a small component, the solder locations would contact the solder iron in the next process and come off and that the leads came into contact with other print patterns causing problems.

This was a cause of increased defects whenever a new operator started to work on the line.

The wiring operations for an 8mm cinecamera are carried out on an integrated wiring basis using one junction printed circuit board. This is ideal for examining any abnormalities with the electrical components. But this concentrated or integrated wiring arrangement has of course the disadvantage that the wiring becomes very complex.

We have therefore made it a point to examine the use of single leads, since we felt that problems could arise also in other parts.

As a result of changing the junction method, we were able to dispense with a total of seven leads.

This reduction in the number of leads required for the wiring meant that the number of soldering location could be reduced by 14. This gave us more space for the wiring jobs so that the solder iron would not come into contact with other leads and with the imprinted pattern. The result was that we were able to achieve soldering.

Fig. 5 only gives those areas for which improvements were made. As a matter of fact, however, there is an even greater number of leads.

Thanks to these measures, the actual defects were again much below the target figures. Before we had about 5 defects a day, but this defect rate we were able to bring down to a statistical 0.6 a day. We are also able to reduce the number of leads on the component by seven so that the measures had a double effect. Our group was thus able to achieve the set target. For the future, we have decided to put a stop to the problems shown in Table 1.

What we have learnt in and through all these activities, is that acting in a group is a major strength. But this requires broad knowledge and excellent team work, and an attitude of never being content with the present but always looking forward.

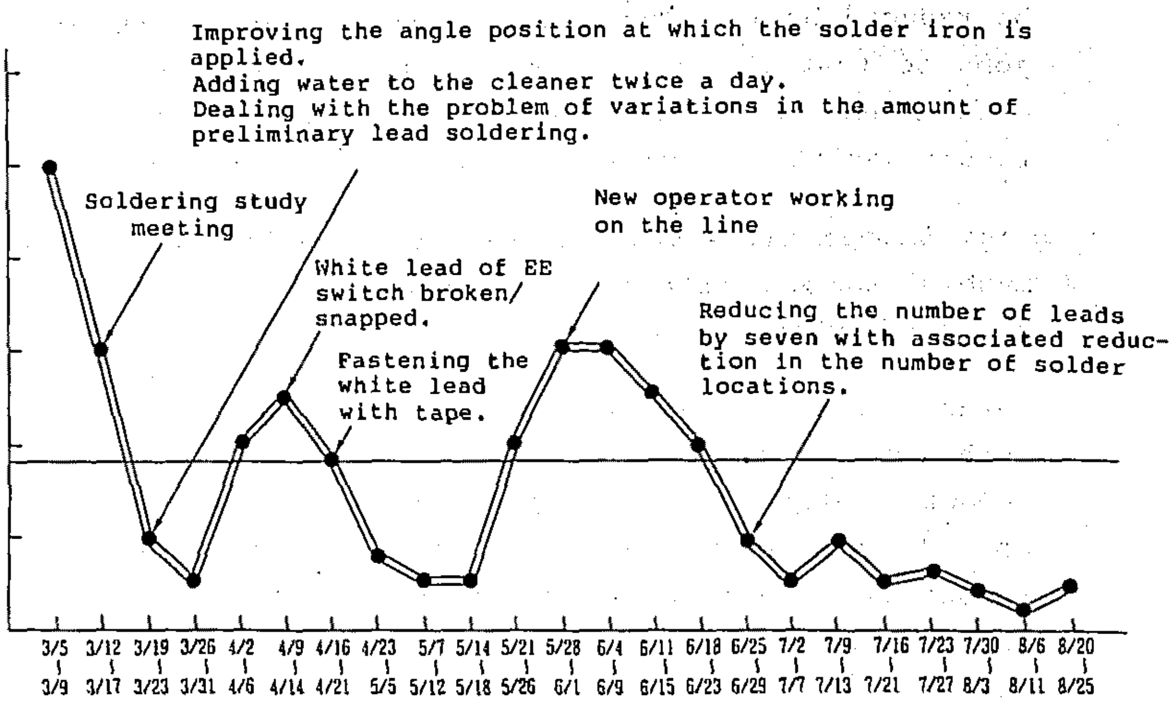


Fig. 4 Trend of QC Activity

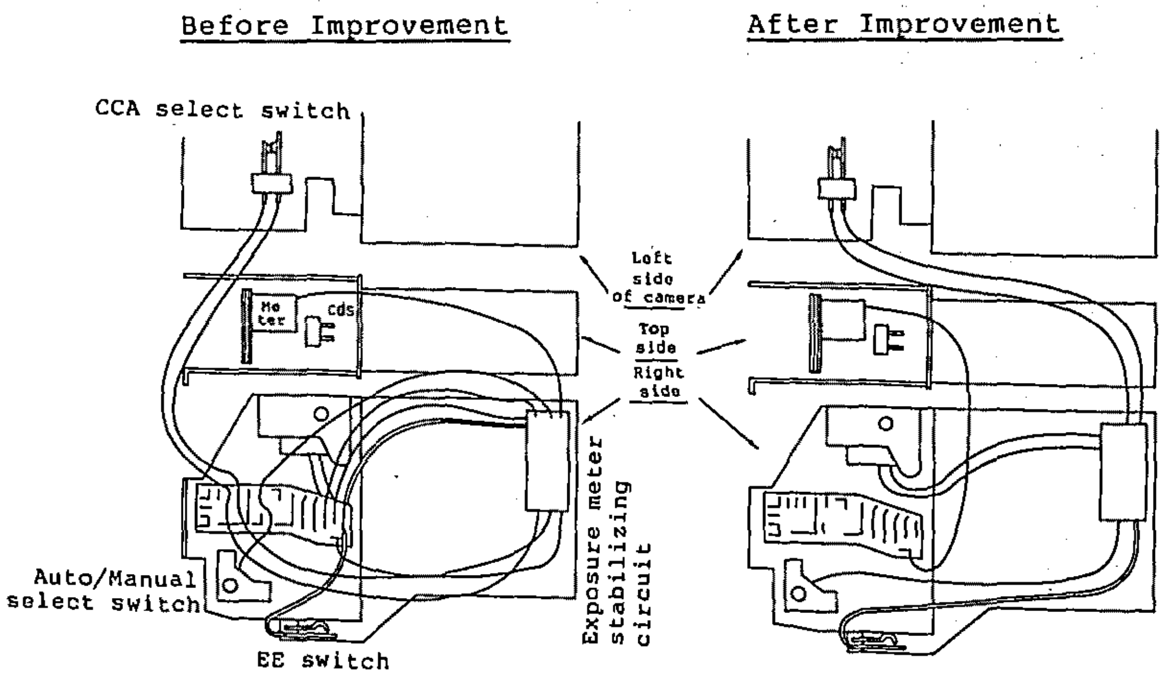


Fig. 5 Change in Wiring

Table 1 Future Control Points (Measures to Stop Problems)

Item	Section Responsible	Person in Charge	Frequency	Control Method
Shape of solder iron head	Assembly	A	Twice a week (on Mondays and Wednesdays)	Tip is broad and round. With wear it gets thinner and eventually is replaced.
Repleneshing cleaner with water	Assembly	Person responsible for soldering	Twice a day (at 8 a.m. and 12.50 p.m.)	A sponge is soaked with plenty of water and left in water until its fully swollen with the absorbed water.
Training in soldering operation	Assembly	A	Once a month	Angle position at which solder iron is applied, check time.
Same as above (in case of new operator)	Assembly	Foreman		Arrangement to be made after operation training.
Finishing the ends of cords/ leads	Acceptance Testing	B	30 per lot	Loose lines/wires, amount of preliminary soldering (Good products, samples of unacceptable product)

EXAMPLE 2 - IMPROVEMENT OF GEAR MACHINING PROCESS AND REDUCING DEFECTS

1. General Description of Factory

This factory produces agricultural machinery.

Practically all of the employees came new to this area when the factory was founded. It is with this young workforce that we have run this new factory.

2. Reason for Dealing with this Process

Given the special circumstances with the factory getting off the ground with a young workforce, we have so far experienced many difficulties in promoting QC team activities. I am personally responsible for the machining of binder and (rice) seedling planter shafts as well as gears. We have always had a problem with the inadequate gear-machining capability we have in this factory. When we make binders, in particular, the work load for our gear machining section becomes too great. This often causes disorder and sometimes have occurred in our machining lines. Needless to say that the defects and rejects also increase in number. Our QC team for gears has dealt with the problem of reducing defective gears. Our gear machining system is as follows.

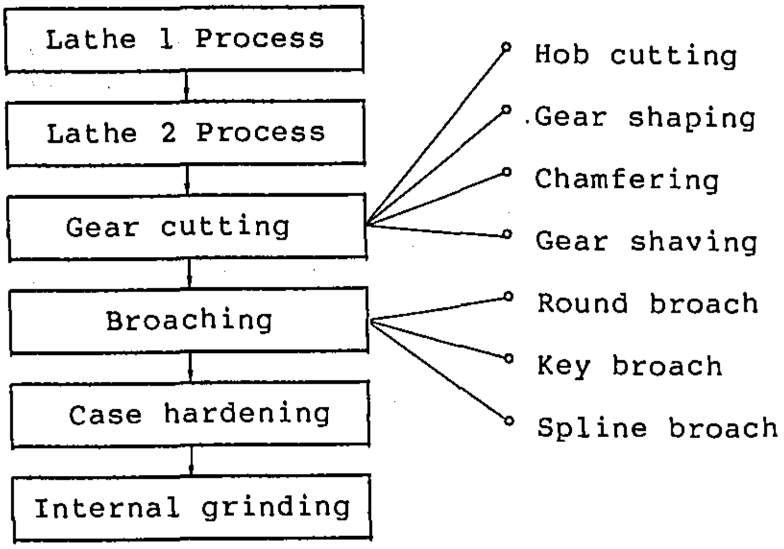
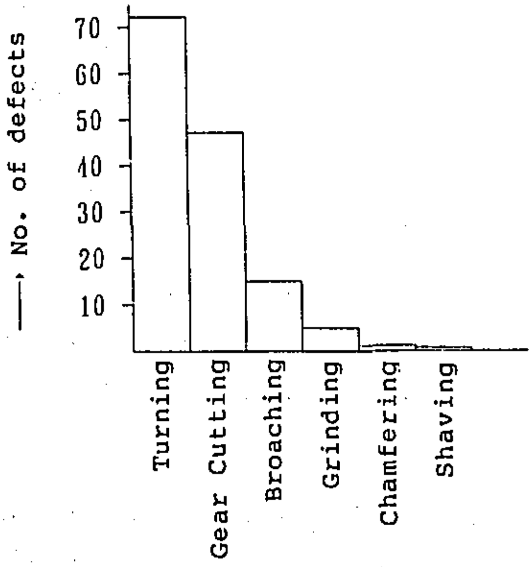


Fig. 1 Gear Machining Process

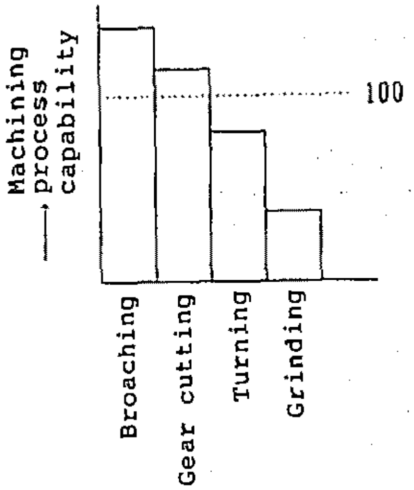
3. Analysis of Current Position and Future Prospects

(1) Occurence of Defects by Process (In the past six months)

As shown in the Pareto Chart of Fig. 2, defects in gear machining are practically limited to the turning and gear cutting operation.



(2) Comparison of Machining by Process



The gear production line has an extremely imbalanced machining capacity, and this leads to disorder in the production process and causes great damage to the production process.

(If we take the capacity to achieve a satisfactory production output as 100, then we are here comparing each process in relation to this target capacity.)

For the gear QC team to reduce, first of all, the defects associated with the turning and gear cutting operations, we have sub-divided the organization into a group specially responsible for turning and a group specially responsible for gear cutting to start our activities by having all group members share a proper knowledge of QC activities.

4. Special Turning Operation Group

Turning defects are a major problem for inner diameter machining. By reducing inner diameter defects, it is possible to reduce defects/rejects. Let us here study inner diameter defects.

We made our studies by preparing and using a Cause and Effect Charts. It is difficult to finish to the nominal tolerance for the inner diameter specifications and reached a hopeless position in trying out countermeasures. The following is an approach based on a philosophy somewhat removed from reality.

"If the nominal tolerance on the inner diameter is expanded beyond its limits, we will reduce defect/reject."

If we adopt this rather simple philosophy, we will arrive at a broach machining capability for a machining method that can fulfill this notion. As can be seen from a chart in which we comparatively examine the various machining capabilities, we will recognize that the broach machining capability is very high. This led us to conclude that broaching might also help us ease the problems on our line with its inadequate turning capacity in the initial operation stage of the gear machining process. So, we tried to go over to broaching to machine-finish the inner diameter of our gears.

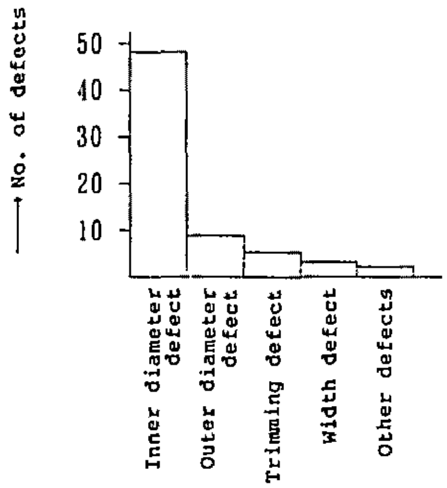


Fig. 4 Pareto Chart for Turning Defects

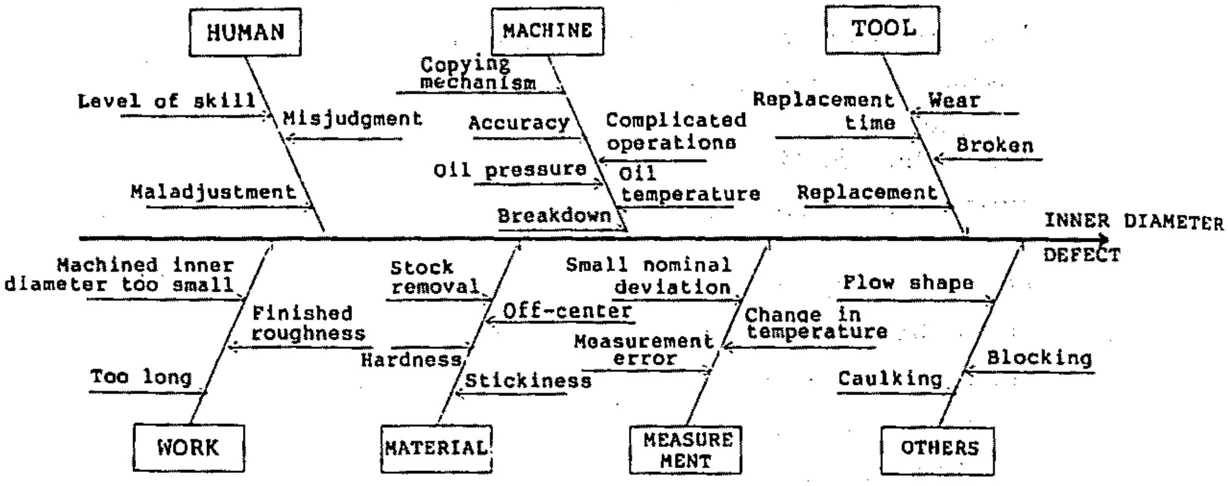


Fig. 5 Cause and Effect Chart

5. Procedure for Experimental Change to the Use of Inner Diameter Broaching

Turning	Inner diameter finish taken as an intermediate finish with some tolerance left (Tolerance of inner diameter is increased and finished surface roughened)
Round broach	Inner diameter finish with a round broach of specified dimension
Gear cutting	Hob-cutting based on the broached hole
Key broach	Key slotting based on the finished gears

Results of Experimental Operation

(1)	Favorable inner diameter accuracy	Within 0.01mm
(2)	Finished surface accuracy Rmax	3 - 4.5um
(3)	PCD deviation	Within 0.05mm
(4)	End-face deviation	Within 0.04mm
(5)	Outer diameter deviation	Within 0.03mm

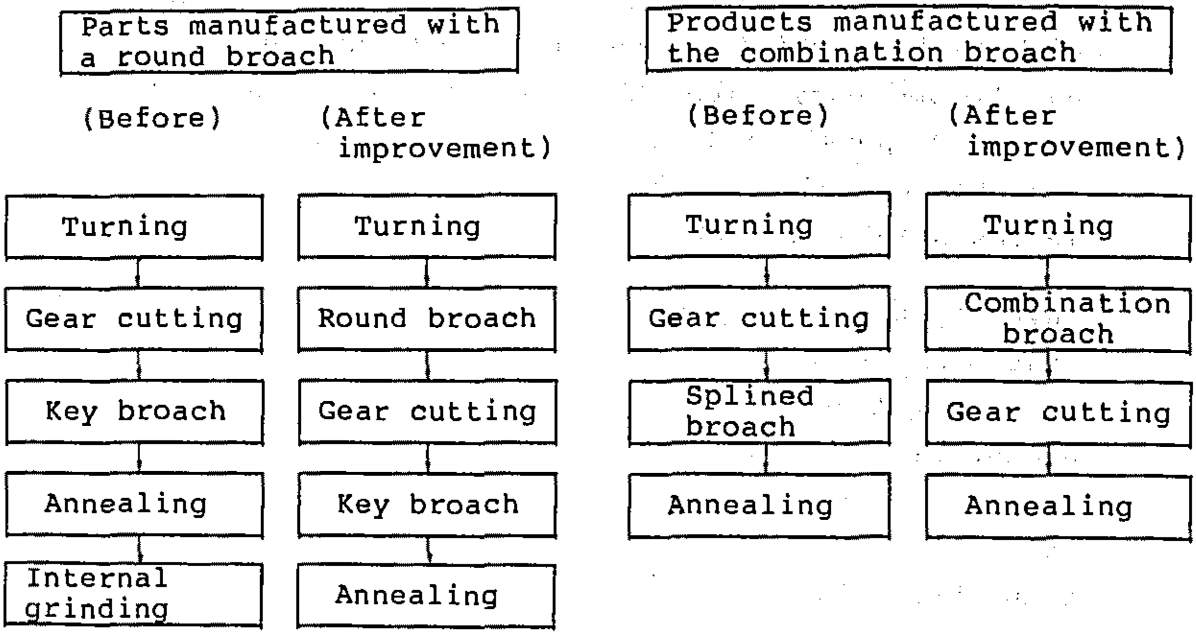
From the above results, it is clear that the accuracy came within the machining accuracy standards and that turning has become easy while the surface finish is good. This makes it possible therefore to dispense with the inner diameter grinding operation, if the annealing contraction is taken into account.

Investigations of annealing contraction have demonstrated that the target values can be achieved if broaching is carried out with a broach size calculated by adding the amount of shrinkage on annealing to the round broach tool size. We have here approved the changes in the drawings associated with the replacement of internal grinding by round broaching.

<Implementation of Inner Diameter Broaching>

Internally ground gears were made using the revised operating sequence.

The QC team achieved very many positive results in raised productivity and reduced defects and began to examine the possibility of promoting internal diameter broaching also for inner diameter splined gears. It introduced a combination broach integrating a round broach with a splined broach to obtain the following process.



6. Gear Cutting Group

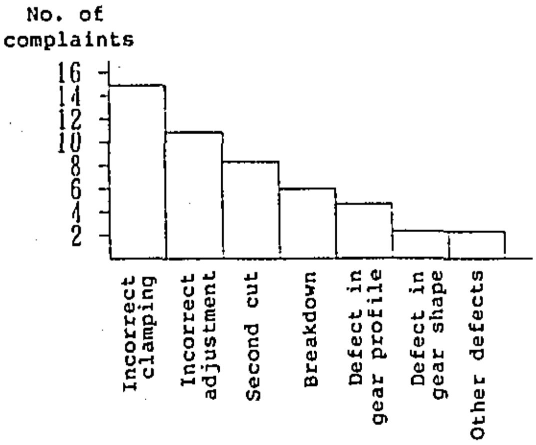
The pareto chart for defects was examined at the Group sessions and the results showed the need for:

(1) Countermeasures against incorrect clamping

(2) Measures to prevent a second cut

(3) Raising the awareness of the operating personnel with regard to preventing incorrect adjustments

It was decided to proceed along these lines by adopting the above three measures to reduce defects.



1) Countermeasures against Incorrect Clamping (Fig. 7)

1 Adjust timing for start of grinding so that grinding starts after works has been completely clamped.

2 Chips will adhere to the clamp arbor or clamp jaw, thereby reducing the clamping action. To prevent this, wash thoroughly with cutting oil and mount nozzle by taking care of the direction in which the chip falls off.

3 Check wear on clamp arbor and clamp jaw and be sure to replace early.

These three measures were implemented. Investigations about clamping problems will also continue in the future.

2) Measures to Prevent a Second Cut

A limit switch had been mounted on the fully automatic rotary type hobbing machine to prevent a second cut from being performed. The operators relied on this device far too much, and are now seriously reviewing their attitude. The magazine that comes after the last unfinished work on the rotary table is generally and without exception left empty.

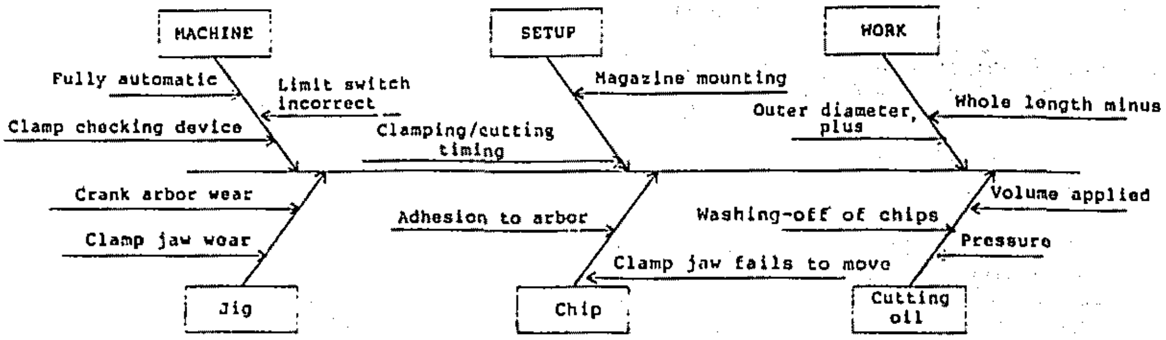


Fig. 7

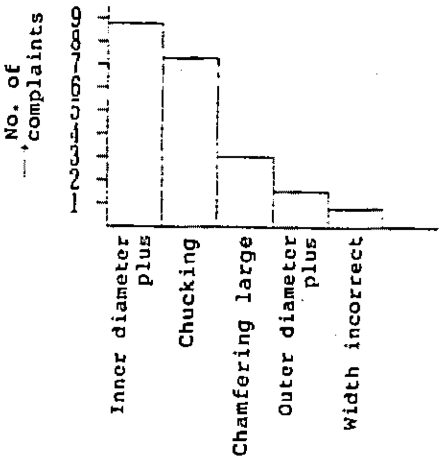


Fig. 8

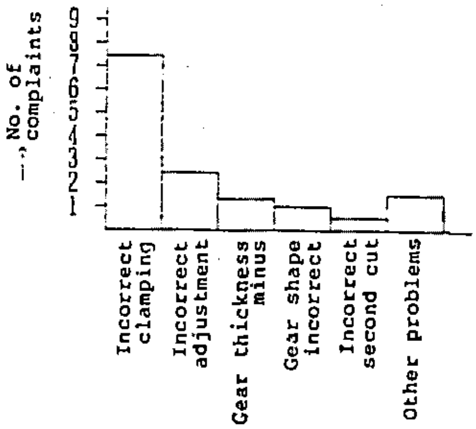


Fig. 9

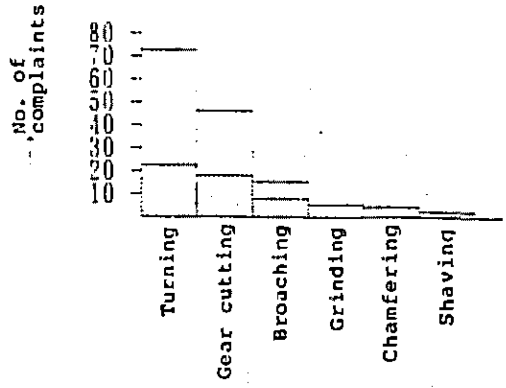


Fig. 10

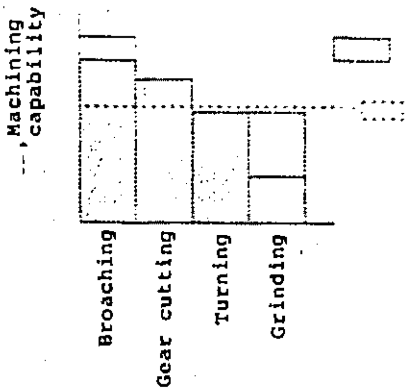


Fig. 11

The results derived from these measures were the following benefits achieved by the Gear QC Team.

1 Successful reduction in the number of defects. (See Fig. 10.)

2 The process as a whole became well-balanced. (See Fig. 11.)

Inner diameter machining on the lathe was replaced by a broaching operation. The result was a roughly 30% increase in the productivity of the gear-machining process. This, in turn, improved the flow of the process further downstream and contributed to an increase in production capacity.

3 Internal grinding was omitted.

4 The operators were able to work regular hours.

7. Improvement Effect

The turning Group achieved a drop in defect as shown from Fig. 4 through Fig. 9.

The Gear Cutting Group achieved a drop in defect as shown from Fig. 6 through Fig. 9 (Reject rate: down from 0.4% to 0.122%).

EXAMPLE 3 - ELIMINATING COMPLAINTS FROM THE NEXT PROCESS STAGE

1. Preface

We took on six multiple-spindle drilling machines for drilling the hub bolt holes of the wheel hubs of automobiles and other bolt or screw holes (cap bolt holes).

2 Reasons for Dealing with this Particular Problem

When minor machining errors have occurred in the finishing of automobile wheel hubs and these hubs are fed through to the next process stage, it takes a long time to correct these errors. This has given rise to very strong requests from within the production line to ensure that such defects are completely eliminated. Correcting one's own errors and defects oneself used to lead to a major disruption of the line work and create serious problems. We have therefore sought to remedy this by having each operator improve his work routine and perform self-checks. These efforts were introduced in earnest, but we did not succeed in obtaining the results we had expected. For this reason, we probed deeper to determine by questioning the personnel why errors and defects did arise in this process stage. It was felt that improvement should be made so that even operators who had newly joined the company would be able to do a proper job within a short time and that training should be provided so that everybody could work with an easy mind and that the finished product would be top class with a consistent high quality.

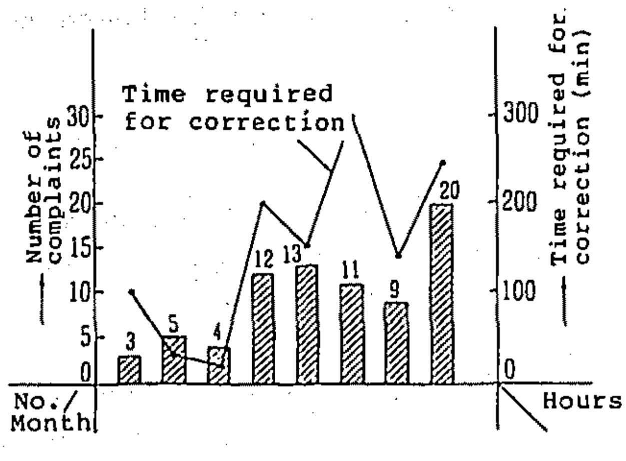


Fig. 1 Number of Complaints per Month and Time Required for Correction

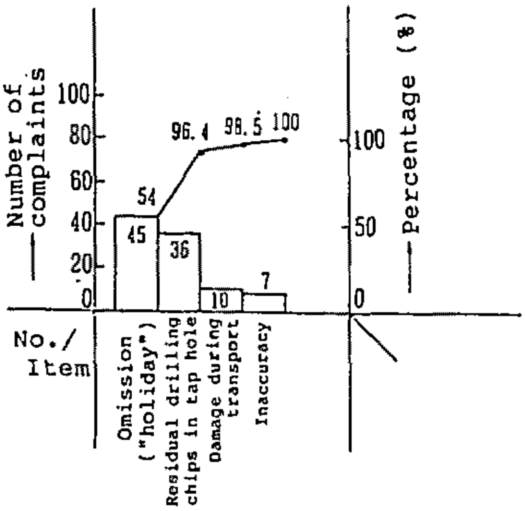


Fig. 2 Pareto Chart by Nature of Complaint

3. Assessment of the Current Situation

We prepared a graph by plotting the number of complaints received from the next process stage against the time required for correction, on a monthly basis. (See Fig. 1)

According to the data for the last 8 months, it was found that the monthly average of complaints was 4 from April through June. This figure then began to rise from July. This rise in the number of complaints did coincide with the joining of two new operators in July and one in November. These new operators were assigned to the line. There was also an increase in production which, in August, amounted to approx. 5,000 units, representing an increase by 1,500 units over the previous month. This, too, may provide a reason for the increased number of complaints.

In terms of the nature of the complaints, these can be divided into four categories: Ommission, residual drilling chips in the tap hole, damage during transport, and inaccuracy. If we break these complaints down, it will be seen that ommission and residual chips in the tap hole accounted for 96.4% of all complaints (See pareto chart - Fig. 2). We therefore decided to talk the problem over with all group members and find the best way to eliminate these two complaints and the reasons leading to these two complaints.

4. Setting the Targets

Target A: Eliminating all Omission and Drilling Chips in the Tap Hole Complaint until January of next year.

Target B: New operators (unskilled operators) should be trained for a short period so that they can do a proper job.

These targets were established with a view to promoting countermeasures within our entire circle. The circle has a membership of 14 (including 5 newcomers). When the circle met, the members failed to venture an opinion. This promoted us to also go ahead with a program designed to create a shopfloor mood conducive to frankness and openness in stating one's opinions.

5. Looking for Problem Areas

We thus had the entire circle get together for discussions on the reasons why omissions and chips residues in the tap holes occurred so often and what to do about it. It was at this point that all members started to be inter-ested and voice their views and opinions. After examining the problems with the whole group, we then preparerd a Specific Cause and Effect Diagram (see Fig. 3).

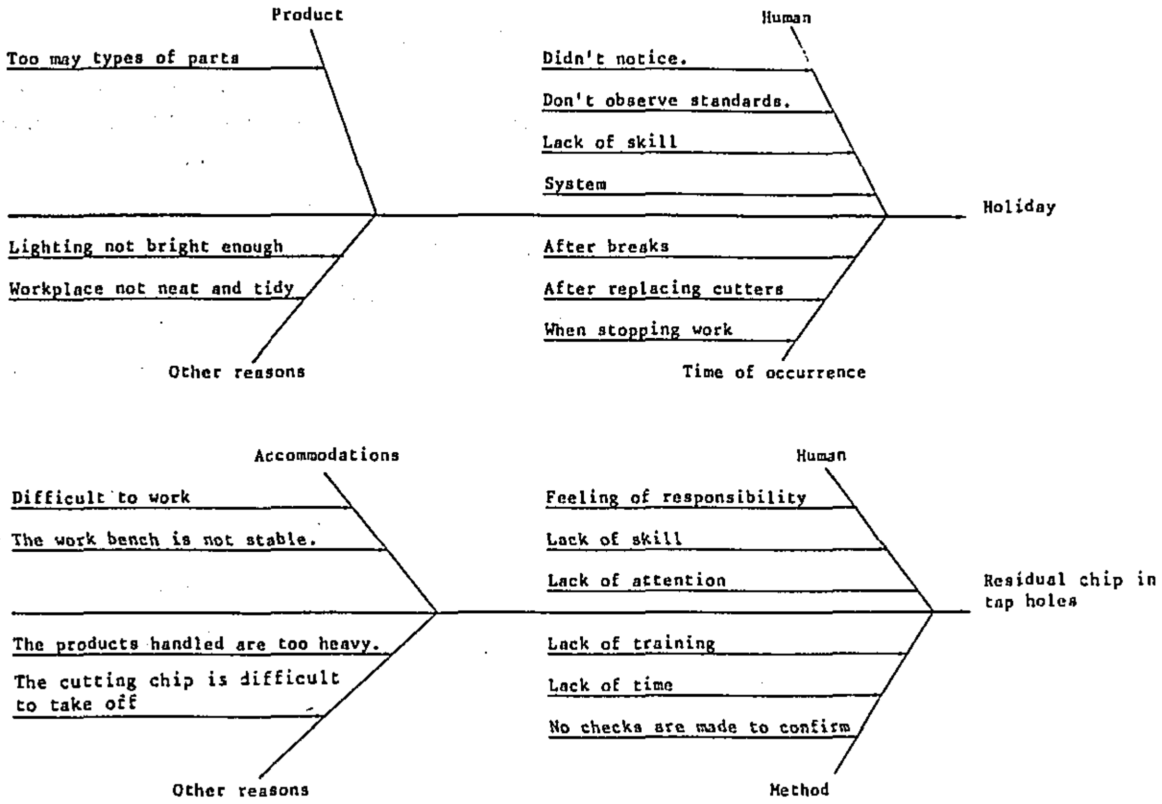


Fig. 3 Cause and Effect Diagram

6. Analysis of Causes

From the Cause and Effect Diagram, we looked for the most serious cause under each item. This led to the following points being taken up.

1) Omissions ("holidays")

   a. The operators themselves do not notice the "holidays" (Holiday = a place to be machined but missed by accident)

   b. Holidays occur very frequently during stoppages and after breaks.

   c. Holidays occur during tool/cutter replacement

2) Chip residue in the tap holes

a. Chip remains because there is too little time to remove it.

b. Chip remains because the operator does not understand the process properly.

c. Chip remains because the operator does not pay enough attention to the job.

Fig. 4 gives the nature of the complaints and the causes and weights them according to the frequency of their occurrence from the Cause and Effect Diagram. This weighted factors chart has been obtained by examining the share each complaint has in the total number of complaints over the given period of the past.

The members of the circle all agreed that adequate countermeasures could be taken and errors/defects prevented if the personnel mutually educated and guided one another and were absolutely strict about checking themselves.

Nature of complaint	Generation/cause of complaint	Incidence
Holiday	By mistake	10
	After interruption of work/after a break	5
	After changing the cutting tool	3
Drilling chip	Time for removal of chip not long enough	6
	Inadequate knowledge about the process	4
	Lack of attention	1

Fig. 4 Complaints received during the period from October through November (2 month period)

7. Implementation of Countermeasure and Effect

Table 1 Details of Implementation of Measures to Deal with Complaints

Name of complaint	Implementation of countermeasures
Holiday	1. Check machining finish of previous process stage 2. Be sure to check, when work is resumed after work has been interrupted or after a break. 3. Conduct a test feed operation after tool has been changed. 4. Training on the machine
Drilling chip left in tap hole	1. Fix a suitable time for blowing the drilling chip with air and make this time standard. 2. Reexamine the operating guide instructions 3. Reinforce the self-checking procedures after an operation has been completed (establish a sense of responsibility).

The countermeasures stated in the Table were established in response to complaints and the following specific measures were carried out.

1) Measures to deal with "holidays"

1. When work has changed, check with your own eyes whether the previous machining operation has been completed or not.

2. Be sure to check that products (work) are located in the machine and that the machining operation has been finished.

3. Check that a display board is affixed in each machining stage, saying that the cutting tool has been changed.

4. If a "holiday" has been discovered in the next process stage all group members shall confer with each other on that occasion to clarify and let each other know in what machining step and at what time this omission has occurred so as to prevent it from arising again.

2) Measures to deal with chip remaining in the tap holes

1. The drilling operation on the multi-spindle drilling machine is completed 30 seconds before the next operation commences, the next operation being the screw-tapping step. This 30 minute gap between the operating steps, is therefore utilized for blowing off the remaining drilling chips, and the standard procedure should be to continue the blow-off operation for the first 20 seconds by pushing down the compressed air foot pedal.

2. In connection with these procedures, the instructions and operating guides for the entire process should be reviewed and the instruction rewritten.

3. A self-checking system should be introduced so that everybody working in the process accepts responsibility for his work by checking himself what he has done.

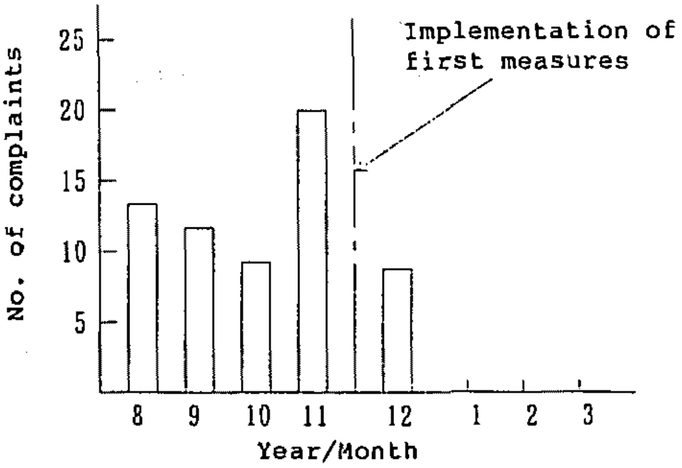


Fig. 5 Number of complaints after the implementation of the first measures

The results achieved through the implementation of these measures made themselves obvious by a significant reduction in the number of complaints. Had the number of complaints received in November, that is, the month prior to the implementation of the measures, been 20, this number was down to only 8 in the following month (December), when the measured were introduced. (See Fig. 5). Despite this drop, the "zero complaint" target was still not reached and the measures did not therefore live up to expectations.

The 8 claims in December were all about "holidays". The other main cuase of complaints had been totally eradicated with the use of a standard blow-off procedure for cutting chips. Another meeting of all group members will have to be convened to clarify and determine the causes of the claims that were still made after the introduction of the measures so that the zero-complaint target may be achieved in January of the following year.

8. Reexamination of the Problem Areas

Another Cause and Effect Chart was made to identify the persisting problem areas. (See Fig. 6)

This new chart gives roughly the same picture as that which had been drawn up before.

9. New Analysis of the Problems and their Causes

Given as causes of "holidays" were reasons such as: "Machine is difficult to operate" and "The work sequence is not good so I tend to forget it". Omissions will thus easily occur due to ancillary operations. There was broad agreement among most group members that the creation of a better morale by the circle members would not be enough to achieve the target that is extremely difficult to attain. It was felt that the full automation of the checking procedure would be the radical solution to completely eliminate the likelihood of complaints. But to replace humans and eliminate the element of human fallability by total automation is a very costly proposition. Deterred by the enormous cost improvement requires, a compromise was made with the introduction of measures designed to simply automate various machine functions while humans do their share wherever it is necessary.

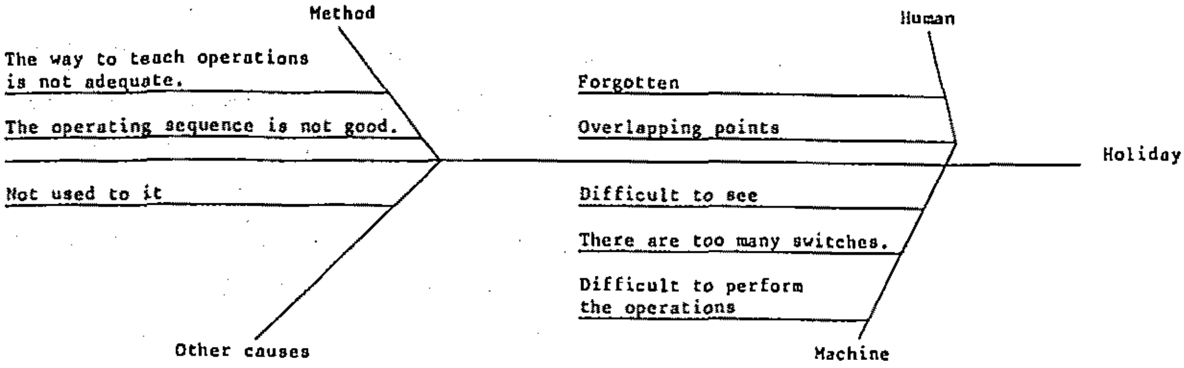


Fig. 6 Cause and Effect Chart for "Holidays" Listed by the Particular Causes

10. Implementation of Countermeasures

Table 2 Improvement Measures in Detail

No.	Nature of improvement	Implementation details
1	Simplification of machine	Introducing switches based on the movement of the products
2	Reducing operator fatigue by automating chip blow-off	Carrying out an air-blast operation to blow-off cutting chip during the machine in process
3	Reviewing the operating sequence	Clearly identifying the operating sequence for all switches

After the implementation details given in Table 2 had been decided, attempts were made to achieve improvements through the cooperation of the Improvement Group.

A multi-spindle drilling boring machine has a large number of switches, and as the production volume increases so the line speed increases. This makes it easy for errors to occur as the operator can easily select a mistaken machine sequence and press a different button rather than the start button, so that when one cycle of the machining is completed and the machines goes back to the starting operation, the operator thinks the machining is finished and goes over to the next stage. This type of error is very common and tends to increase as the volume of production increases. To prevent this, it has been proposed that a product-feeding rail should be attached to the front of the machine and a limit switch mounted between the process stages. This proposal has been adopted for implementation by the Improvement Group.

When the product moves, it will press and actuate the limit switch which is coupled with the start switch of the machine so as to ensure that the machining process is completed before the next operation can begin.

Similarly, measures have been embraced to ensure that the drilling chip is blown off, without fail, from the tap holes. For this purpose, the machine stroke is utilized and coupled to the air-blast unit for blowing off the tap hole. This is to make sure that the chip is removed while the machine performing the previous operation is being operated. Thanks to this improvement, the fatigue element has been very much reduced to permit combined operation at a high level of efficiency.

11. Effect of Implementation of Improvement Measures

The implementation of the above improvement measures proposed by the QC circle produced the following beneficial effects.

Thanks to the implementation of these measures, it was in fact possible to achieve the "zero-complaint" target in January of the following year. This also eliminates the need for repair to make good defects.

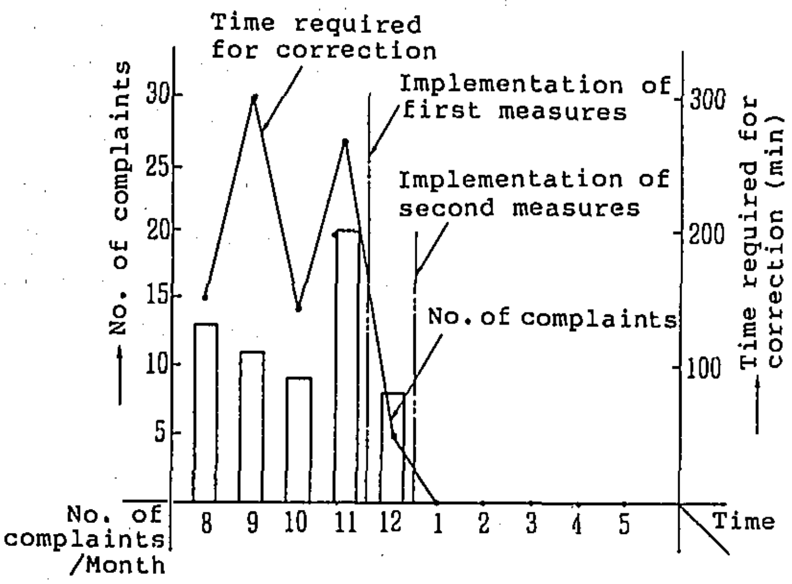


Fig. 7 Number of Complaints vs. Time Required for Correction over a Period of Time

The measures also had another ancillary effect. There were no more complaints. The mood of the staff become much more relaxed so that the workplace offered an environment easy to work in with a high level of operating efficiency.

12. Standardization

To maintain the quality of work on target with a zero-complaint level, it will be absolutely imperative to check all switches prior to operation and to confirm that the equipment is in the operational condition. For this purpose, we have introduced a check sheet so that the performance of checks have been made a routine matter.

EXAMPLE 4 - REDUCING ERRORS IN CHECKING PRODUCT APPEARANCE

1. Preface

The factory concerned specialized in the manufacture of cases for men's watches. The workplace for which I am responsible is a finishing sections equipped with a buffing, grinding and similar surface-finishing machinery. Fig. 1 is a layout of the machining process concerned.

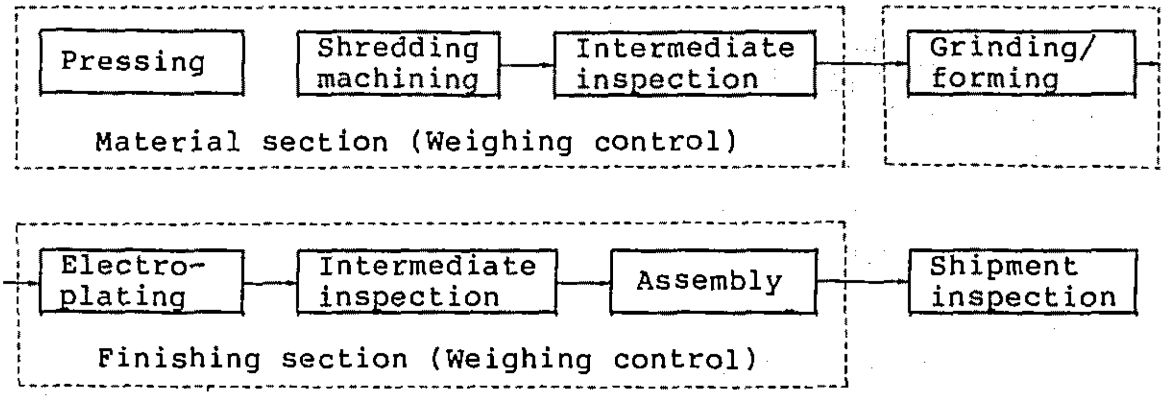


Fig. 1

2. Reasons for Discussion

At my workplace, there are 44 operators covering various machining operations such as buffing, finish-grinding, and pattern application. As shown in Fig. 1, the inspection procedure is limited to one location for each section.

In small-lot production with a great variety of products, the design changes all the time. This makes it extremely difficult for each operator to get thoroughly familiar with each new check points as it arises, in short time. The problem, however, is that if one operator does not do his job well and with a good understanding of what he is required to do, the next operating stage in the process will meet with the greatest difficulties. Repair or retouching may be necessary and it may also become very difficult to keep a proper control on delivery times. The most important factors to which these difficulties can be attributed are the inadequate quality-consciousness on the part of the operator and errors committed in the inspection process. It is therefore a matter of primary importance to establish ways for eliminating such errors in the inspection process and of reducing problems.

3. Analysis of the Present Situation

At our workplace, we carry out inspections with our own risks, four operators classifying all products of any one production lot to look for defective products. If defective products are found, they are corrected before they are sent to the next process stage.

The success rate for product that pass muster is around 60 - 70%. These data have been compiled and presented in the following Pareto graph. (See Fig. 2, 3)

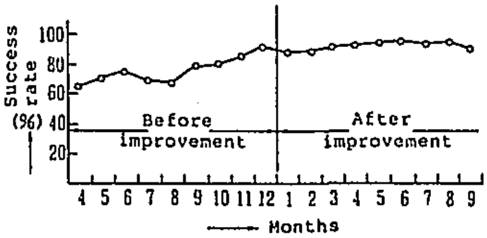


Fig. 2 Changes in Success Rate on Appearance Inspection with Time

As shown in this Pareto graph, defects including scratches on the case body and the case side, have a rather high share in the overall defect rate.

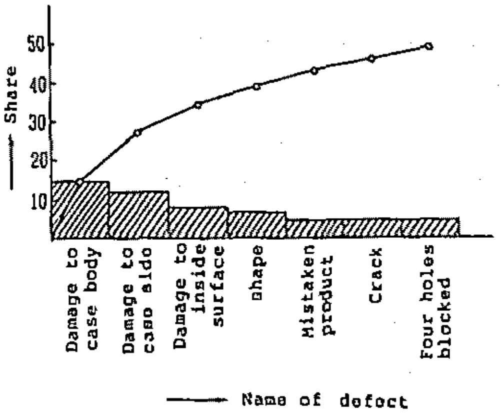


Fig. 3 Pareto Graph by Outgoing Lot Defect

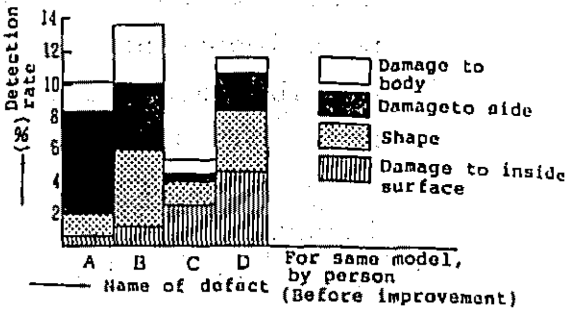


Fig. 4 Detection Rate by Cause

Investigations were carried out by the operators, the staff, and the QC circle leaders, and also the inspectors (operators) checked among themselves to what extent their findings varied. As a result, it became very clear that there were significant differences between the individual operators, as shown in Fig. 4. The data of this figure were obtained by having each person investigate the same sample containing a particular type of defective property. It is clear that the investigators varied in the results of their findings.

Mr. A had the poorest detection ability for body defects, while Mr. B lacked the ability to make correct detections for any of the properties concerned, discovering too large a number of defects. Mr. C was the opposite of Mr. B in that he found too little defects. From this test, it is clear:

1. that opinion differs from operator to operator concerning what a defect is in each case.
2. the way the checking is performed does have a bearing on the accuracy of detection.

When the same sample is investigated, it is logical that different people should detect the same defects in that sample. If operators disagree in their findings concerning the same sample, there must be something wrong with the way the checking is done. On this philosophy, the circle members were convened and a cause and effect diagram was established. As a result, it emerged that while there were straightforward personal differences in the passing of products at the shipment inspection, the real reason for the discrepancies was attributed to problems with the operating standards and the inspection methods. This matter was therefore examined in closer detail.

4. Problem Areas

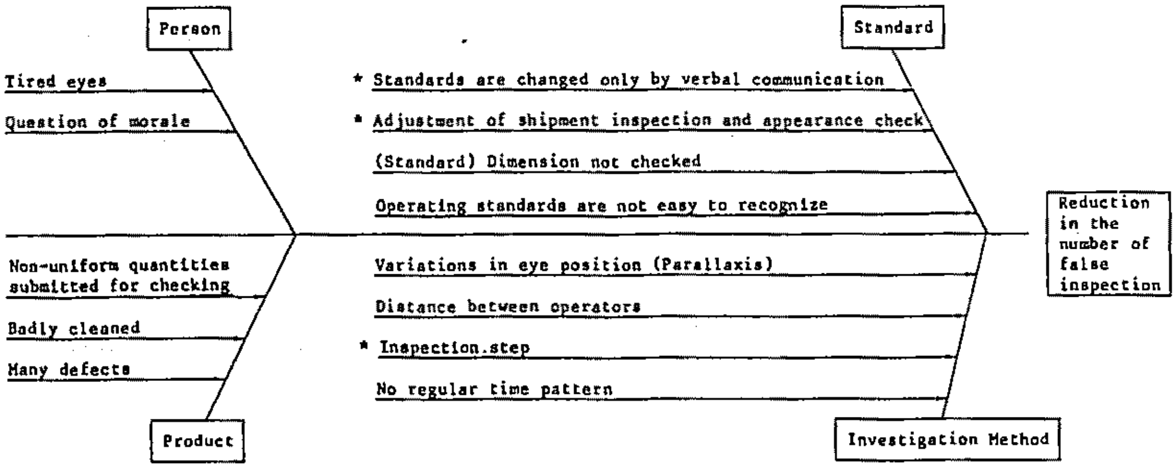


Fig 5

The problems areas can be categorized as follows.

1) Instructions are not properly transmitted.

2) There are differences in the assessment criteria for shipment inspection and for checking product appearance.

3) Operating standards are not easy to recognize.

4) The sequence of inspection is not clear.

5. Countermeasures

1) Whenever new products are released, a boundary sample should be prepared for each property and measures are taken to avoid problems through consultation between and with the departments concerned.

2) For properties which were found unacceptable in case of returned products, all inspection staff members should re-check and re-confirm, and take whatever measures are necessary to prevent the re-occurrence of any future return of goods. (Re-assessment of boundary sample, re-examination of standard)

3) Non-specified boundary samples shall be made definite and where specifications are inadequate these shall be replaced and introduced as an inspection tool. (Expiry of time limit, contamination, discoloration)

4) If defects have led to the return of goods, the entire group staff shall check and confirm the defects missed at the time of visual inspection and examine their ability to detect defects and the appropriateness of their assessment. If necessary, training and guidance shall be provided.

5) Explanations to charts shall be given to make the operating standards easier to use, and also the procedure shall be made clear. (Table 1, Table 2)

6) The results of the shipment inspection shall be reported to the inspection staff on a daily basis, calling for greater attentiveness.

7) Training shall be provided to convey the necessary knowledge and skills to the inspection staff. (Based on reference materials)

Table 1 Old Operating Standards

(1) Body of Unit

Operating Standards		
No.	Step	Major defect
1	Check inside surface	Looseness, scratches left after polishing/grinding, dirt
2	Examine side surface	Looseness, dirt, vending
3	Side of body	Scratched surface, clouding after polishing/grinding
4	Surface of groove	Dirty, broken
5	Check pipe hole	Dirty
6		Dirty, dirty scratches burn

(2) Body in One-piece Type

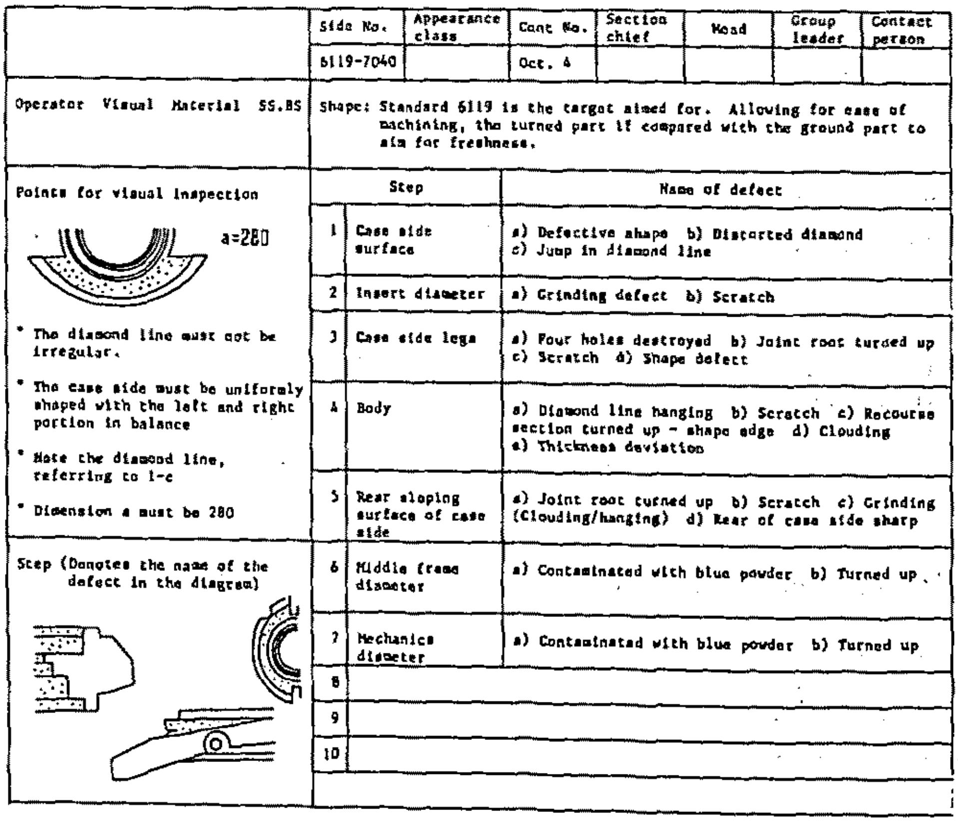
Operating Standards		
No.	Step	Major defect
1	Check inside surface	Looseness, scratches left after polishing/grinding, dirt
2	Check snappring insert diameter	Scratched/damages, dirty
3	Check inner surface	Stains, dirt
4	Check mark	Burn, dirt
5	Check outer circumference	Dirt in each grind groove
6	Check pipe hole	
7	Surface	

(3) Body in Sealed Type

Operating Standards

No.	Step	Major defect
1	Check inside surface	Looseness, scratches left after polishing/grinding, discoloration, dirt
2	Check outer surface	Dirt
3	Check pipe hole	Dirt
4	Check rear sloping surface	Scratch/damage, coulding
5	Check insert diameter of packing	Dirty
6	Check internal surface	Dirt at screws

Table 2 New operating Standards



Side No.	Appearance class	Cont No.	Section chief	Head	Group leader	Contact person
6119-7040		Oct. 4				

Operator Visual Material SS.BS

Shape: Standard 6119 is the target aimed for. Allowing for ease of machining, the turned part if compared with the ground part to aim for freshness.

Points for visual inspection

a=280

- The diamond line must not be irregular.
- The case side must be uniformly shaped with the left and right portion in balance
- Note the diamond line, referring to 1-c
- Dimension a must be 280

Step (Denotes the name of the defect in the diagram)

Step		Name of defect
1	Case side surface	a) Defective shape b) Distorted diamond c) Jump in diamond line
2	Insert diameter	a) Grinding defect b) Scratch
3	Case side legs	a) Four holes destroyed b) Joint root turned up c) Scratch d) Shape defect
4	Body	a) Diamond line hanging b) Scratch c) Recourse section turned up - shape edge d) Clouding e) Thickness deviation
5	Rear sloping surface of case side	a) Joint root turned up b) Scratch c) Grinding (Clouding/hanging) d) Rear of case side sharp
6	Middle frame diameter	a) Contaminated with blue powder b) Turned up
7	Mechanics diameter	a) Contaminated with blue powder b) Turned up
8		
9		
10		

6. Effect

As seen above, the implementation of the above measures were effective in improving the efficiency of the procedures as indicated below. This, as can be seen from Fig. 2, we took a period of 12 months as the reference time for evaluation. It was possible to maintain the success rate at 99%. The implementation of training programs also helped reduce the personal differences, as can be seen from Fig. 6, while the ability to detect defects for all of the properties included in the sample was improved.

By aiming at the quality of visual inspection, it was thus possible to reduce the personal variations and discrepancies in the inspection process as a whole, as shown in Fig. 8. At the same time, it was possible to achieve a smooth transmission of data to the previous process stage, with the result being an improved yield and a reduction in the need for corrections.

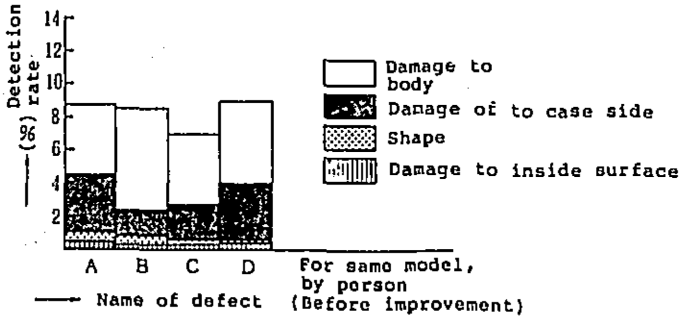


Fig. 6 Detection Rate by Cause

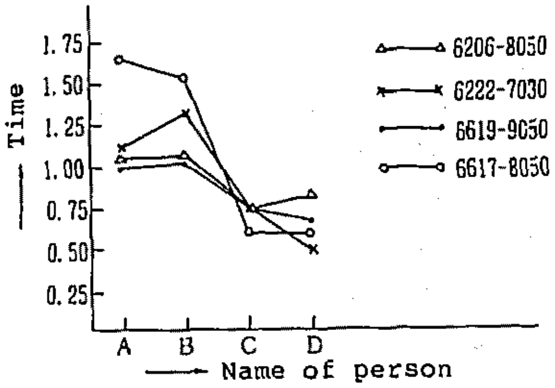


Fig. 7 Inspection Time per Unit (100) (Before improvement)

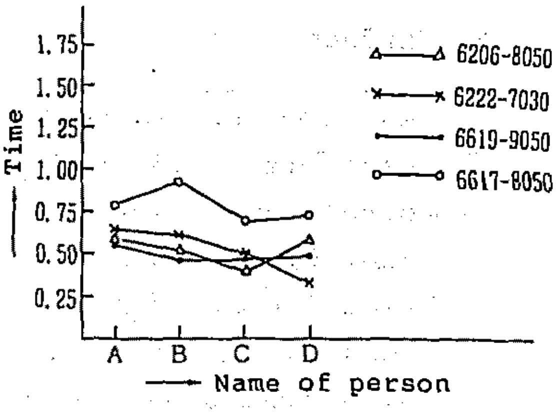


Fig. 8 Inspection Time per Unit (100) (After improvement)

7. Summary and Conclusions

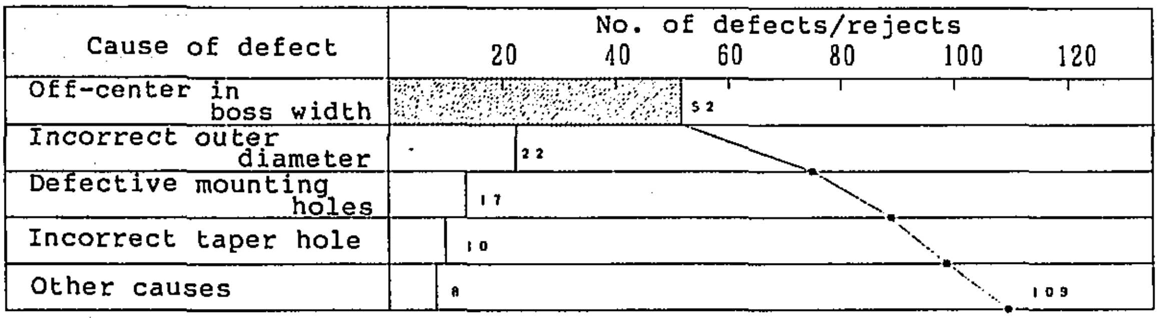
In sensory (visual) inspection procedures, inspection is performed not on the basis of objective, uniform inspection methods, but rather on criteria that change with time and place. Recently, there have been many difficulties in the regard. We have therefore tried to accurately pinpoint the problem areas by mobilizing mainly the QC circles and by teaching the correct methods and providing a system of effective horizontal and vertical communication. Through these measures we were able to achieve a positive effect. Again, through the mobilization of the QC circles we want to raise the awareness of quality in each member of the personnel and make great efforts to increase efficiency and resolve the many problems as they arise in day to day work.

EXAMPLE 5 - MEASURES AGAINST REJECTS IN THE MACHINING OF STEERING KNUCKLE JOINTS

1. Preface

The report relates to measures against rejects and defects in the machining process of automotive parts and refers to associated measures designed to reduce costs.

2. Assessment of the Actual Status of the Occurrence of Rejects and Defects



Reject rate: 0.51%

Fig. 1 Pareto - Percentage Reject Rate by Cause of Defect

The reject rate figure above gives the status of defective machining as of December of last year, when it was decided to re-confirm the conditions of machining defects with a view to implement the appropriate countermeasures.

While the reject rate is low at only 0.51%, it must be remembered that steering knuckles are an essential component in terms of assuring vehicle safety and that the loss due to defects in steering knuckles is relatively greater than in the case of other automotive components. The severity of the loss results from the fact that steering knuckles are forged parts of considerable complexity. For these two reasons, we adopted the view that the target for the reject rate should be "zero." The percentage rate figure broken down by cause of defect indicates that the numerically greatest incidence of defect arises from "off-center in the boss width."

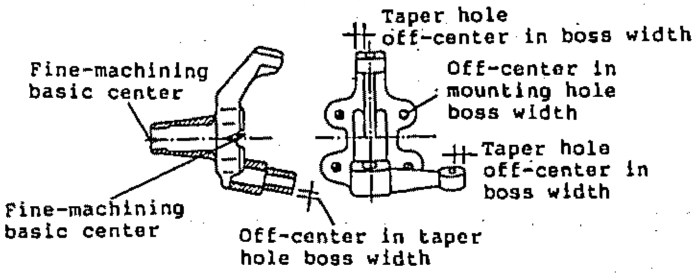


Fig. 2 Current Position of Occurrence of Off-center in Boss Width

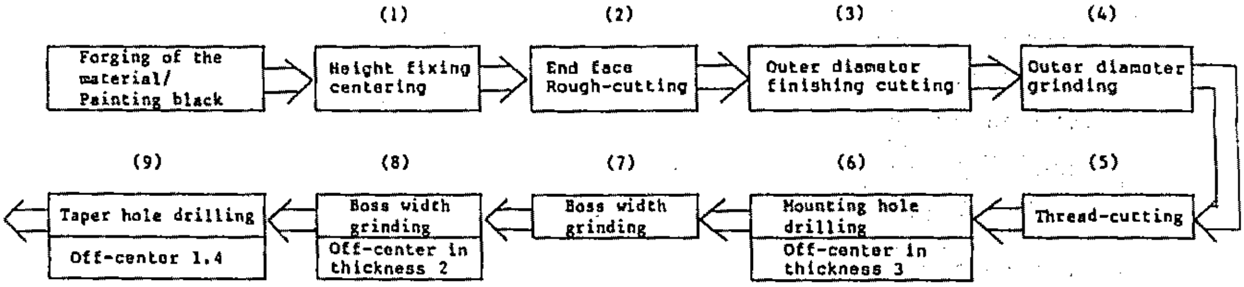


Fig. 3 Outline of Machining Operations

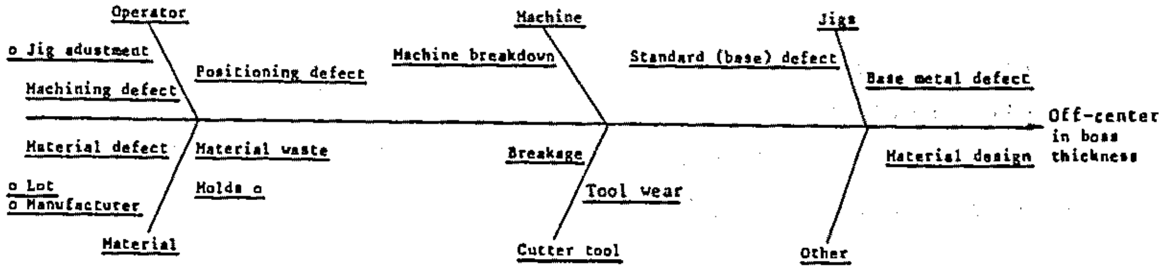


Fig. 4 Causes of Off-center in Boss Thickness

3. Locations in which Off-center of Boss Thickness Occurs

Fig. 2 shows that off-center in boss thickness is the most frequently occurring defect. It occurs in four locations, and in the overwhelming majority of cases it can be found in the boss width and the taper hole. As shown in the figure, the component has a very complicated shape, with the machining executed by taking the center as the reference or base so that defects will arise in the fine-machining operation carried out afterwards.

4. Description of Machining Operation

As shown in Fig. 3, the reference centers for later machining process are fixed by centering, then machining process follows. Off-center in boss thickness occurs in the machining operations from 6 through 8 to 9.

5. Causes of Off-center in Boss Thickness

To establish and implement countermeasures, a chart giving the causes of off-center in boss width has been established at meetings to which all operators had been called. Various causes were given, and the cause which from a technical viewpoint appears to account for the majority of this defect is associated with the material. The next most common cause is due to the operators, in other words, they are operational defects. These two area of defect were then further analyzed.

6. Analysis of Causes due to the Material

(1) Material manufacturers and lots

This product is for the company's main production vehicle and is manufactured in large quantities. There are three manufacturers, and they all have such severe working conditions in terms of quality control that corrections on forging dies have to be made around 13 times a month. This has prompted us to investigate the material accuracy levels for the different manufacturers and lots.

By manufacturer	Part handled	Inventory rate	Need for die correction in December
Company A	Right side only Total number	50%	7 times
Company B	Left side	25%	3 times
Company C	Left side	25%	3 times

Fig. 5 By Material Manufacturer

(2) Characteristics of materials by manufacturers

As has already been stated earlier, off-center in boss thickness accounts for the overwhelming majority. For this reason, the material accuracy has been studied by manufacturer in terms of parts a and b, to determine the characteristics that have an effect on off-center in taper hole boss width and on off-center in boss width.

As a result of these investigations, it has been established that for part a, the material specifications were not met by any of the manufacturers and that there were dispersions in the order of 2 or 3 times the standard specification values. On a lot basis, it was found that there were dispersions in the order of 1 - 1.5mm. For part b, the same inadequacy in meeting the specifications was again found. As a result of these investigations, attempts have been made to call upon the material manufacturers concerned to do their utmost to improve their accuracy standards. The judgment was made that the material manufacturers lacked the capability to meet the accuracy standards with their process technology. It was also found that there were substantial margins of error in the design of the materials. This makes it unavoidable therefore to resort to adjustment operations in the machining process.

7. General Description of Centering Work for Reference Line

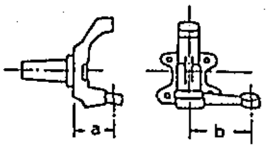


Fig. 6

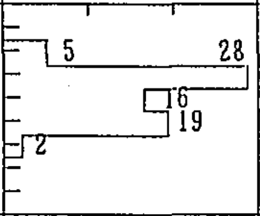
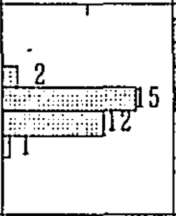
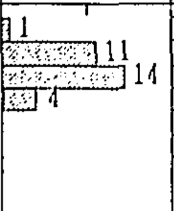
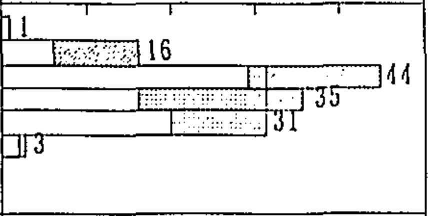
Manu facturer	Company A	Company B	Company C	All 3 Companies
Material	70 pcs.	30 pcs.	30 pcs.	130 pcs.
Numerical value	10 20	10	10	10 20 30 40
Unit: mm +1.5 +1.0 +0.5 0 -0.5 -1.0 -1.5 -2.0				
X	+ 0.1	− 0.2	+ 0.65	+ 0.16
6 σ	3.12	1.98	2.16	3.5
C P	0.32	0.5	0.46	0.29
Within lot R	1.5	1.0	1.0	

Fig. 7 Dimensional Accuracy of Material for Part a, by Manufacturer - Specification Value 69.3 ±0.5

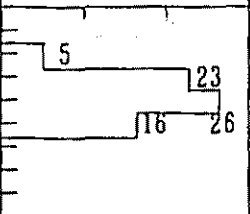
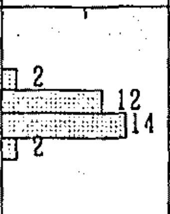
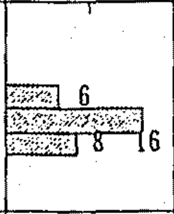
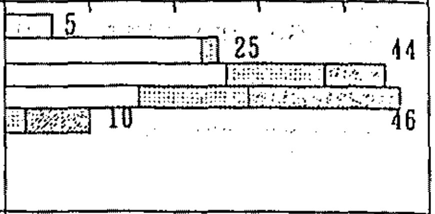
Manu facturer	Company A	Company B	Company C	All 3 Companies
Material	70pcs.	30pcs.	30pcs.	130pcs.
Numerical value	10 20	10	10	10 20 30 40
Unit: mm +1.5 +1.0 +0.5 0 -0.5 -1.0 -1.5 -2.0				
$\bar{x}$	+ 0.1	− 0.27	− 0.54	− 0.12
6 σ	2.64	2.16	1.83	3.0
C P	0.6	0.74	0.87	0.53
Lot R	1.0	1.0	0.5	

Fig. 8 Dimensional Accuracy of Material for Part b, by Manufacturer - Specification Value 113 ±0.8

The material is put on the jig shown in Fig. 9 and centering is performed while the reference line is adjusted so that no off-center in boss width thickness occurs. Since investigation of the material shows significant variations in accuracy, it is practically unavoidable to make these adjustments. The measures we feel should be pursued is to enlist the cooperation of all those involved in the work to ensure that suitable measures are adopted so that the rate of occurrence of defects due to incorrect adjustment will be minimized and the number of operations required for adjustment as a result of an increased need for adjustment will also be reduced.

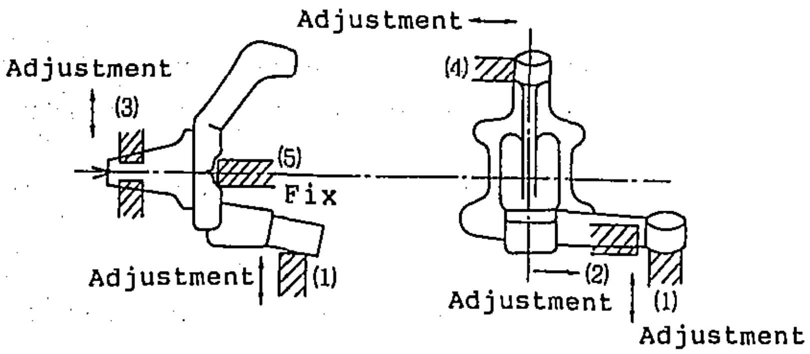


Fig. 9 Centering Work for Machining Reference Center

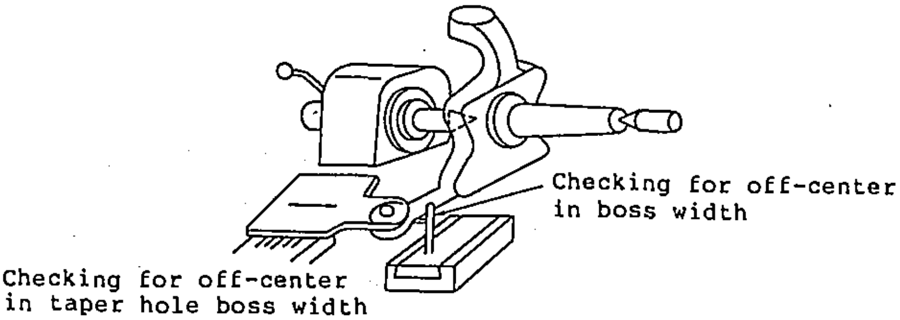


Fig. 10 Measure 3 Checking Device of Machining Reference Center

8. Measures

(1) Consistent lot control of material by manufacturer and by lot

In the conventional black-painting operation, the materials stemming from different lots used to be mixed together. By classifying the materials by manufacturer and by lot, however, it has been possible to effectively reduce the rate of defective adjustment and the number of adjustment procedures required.

(2) Establishment of standards for centering work

The adjustment time can be substantially reduced by standardizing the standard position for the jigs.

(3) Establishing checking equipment for center hole position

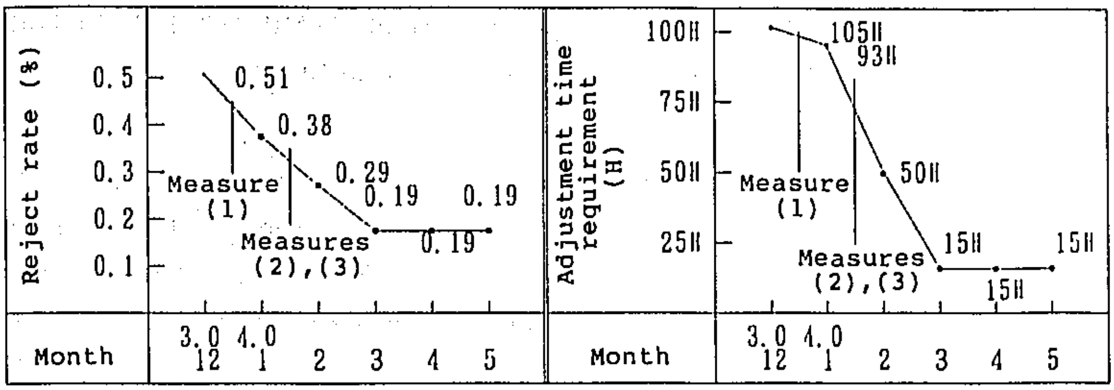
To establish whether or not the center hole position is correct, the traditional practice has been to run a pilot through to operation 9, as shown in Fig. 3, and to check. To reduce the adjustment time, however, the checking equipment shown in Fig. 10 has been established.

9. Effect

(1) Reduction in reject rate from 0.51% to 0.19%.

(2) Reduction of adjustment operation time (in hours) from 105 hours to 15 hours (approximately by 1/7th).

As shown in Fig. 11, the defect or reject rate and the time required for adjustment has been substantially reduced by implementing these proposed countermeasures. It has thus been confirmed that the effect of our measures has been significant. In addition to these two effects, the measures have also had a major effect on the operators in heightening their awareness and interest in improvements and in strengthening their quality-mindedness.



Reduction of Reject Rate

Reduction of Adjustment Time Requirement

Fig. 11 Effect

10. Future Areas to be Considered

(1) Forgings generally have a greater dispersion range than castings. This calls for the need for further development work in such areas as the investigations of machining standards and checking equipment.

(2) Management of Lot Rechecking

EXAMPLE 6 - REDUCTION OF DEFECTS IN OUTER DIAMETER DIMENSIONS FOR CYLINDRICALLY SHAPED COMPONENTS

Some components show very large dispersions in their outer diameter dimensions. This led to attempts to improve dimensional inaccuracies. Data were taken and plotted in a histogram as shown in Fig. 1. The histogram gave a very clear idea as to how the outer diameter dimension varied against the specification values. Let us take the outer dimension grinding process first. This type of grinding is performed on three grinders. Two operators mind the previous operation step. To get a more differentiated picture, we examined the outer diameter grinding process by breaking it down into machine (grinder), operator, and measuring personnel. The results thus broken down were then again plotted in a histogram. This did not provide a clear and unmistakable way of determining the causes of the dispersions without having to calculate the average values and standard deviations. This breakdown analysis was thus not successful. We then studied the previous operation, when it was found that the two operators concerned did use different machining procedures. This led us to assume that this difference could account for the variations. We therefore examined the previous operation by breaking it down by operator. With the results, we plotted a histogram of the variations in outer diameter after outer diameter (external) grinding. It can be seen from Fig. 2, that the variations for operator B are particularly great.

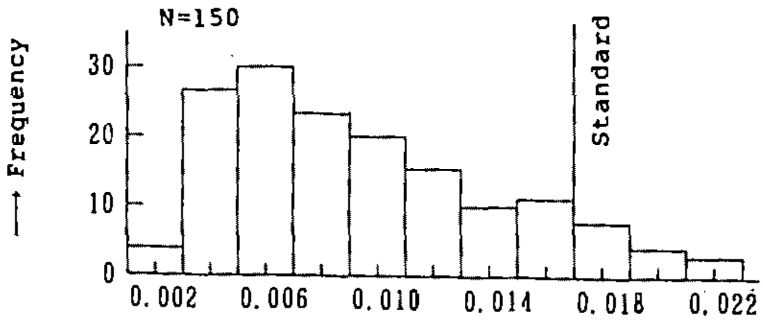


Fig. 1 Outer Diameter Variation

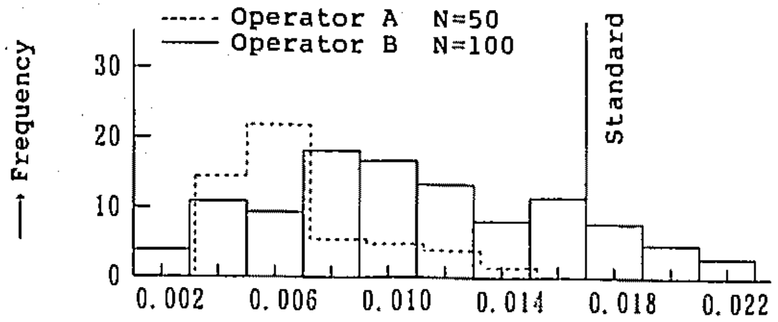


Fig. 2 Histogram Broken down by Operator

Very close scrutiny of the machining methods used by operator B revealed that his dispersions could be brought down by changing his work methods. The histogram shown in Fig. 3 shows that the specification values were met after he had suitably changed his work methods.

The most crucial consideration in preparing such a breakdown histogram is the question as to how it is possible to look for and determine the cause or causes that are most critical. It often happens that the causes of defect are hidden in areas of the process nobody would ever think of. If the breakdown is left to the knowledge or experience of one particular person, they may be the great danger that the most important cause or causes will be completely overlooked. If, however, a chart of characteristic causes is used and the knowledge and experience of each and all operators are collected to obtain a broken-down picture, the result will be effective.

In dealing with the practical problems as they arise in the factory, it is certainly difficult to decide how the histogram should best be broken down. Despite this general difficulty, let us take up the general items on the basis of the four M's (Man, Machine, Material, Method) that are essential for production as we go about our task to make a breakdown.

(a) Operator: Breakdown by individual, by workplace, by shift, by experience

(b) Machine/plant: Breakdown by machine, by jig

(c) Materials: By source of purchase, by brand, by lot received.

(d) Operating method: and by all kinds of operating conditions for machining, assembly, measurement and inspection

(e) Time: By morning/by afternoon hours, by year/month/week, by season of the year

(f) Environment: By climatic condition, by indoor environmental condition, by condition such as electrical field/magnetic field, etc.

(g) Other conditions: By condition of occurrence, by location/position of occurrence

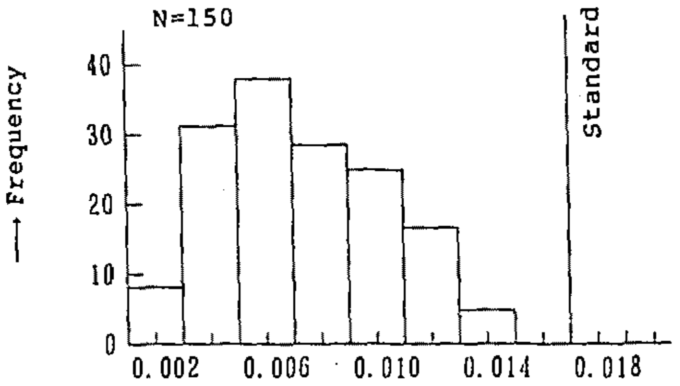


Fig. 3 Variation in Outer Diameter after Improvement

Even if, in the case of electrical components, the variation in the characteristic values determined on component inspections is small and the dimensions may well be within the standards, a breakdown by material manufacturer shows that the differences as they exist from manufacturer to manufacturer come out very clearly when a histogram is prepared with the characteristic performance values for the assembled parts. This means that due attention must also be given to the way in which the characteristic values are taken.

As can be seen from this example, when there is a difference between two stratified histograms, it is not possible to show two characteristics in the histogram as a whole and all that can be done is to present the results for the characteristic which has a large variation. Consequently, when a histogram is prepared by making a breakdown, the number of data will become smaller when a breakdown is made so that, in some cases, it is no longer possible to prepare a histogram. When this happens, it may be good way out to make the differentiation in one histograms as shown in Fig. 2 or to use identification colours for comparison.

EXAMPLE 7 - REDUCING MACHINING DIMENSION ERRORS FOR RESIN MOLDINGS

When special resins are molded and machined to produce electro-mechanical parts, it can be found that there is a considerable variation in the main dimensions of the products so that the dimensional errors have to be corrected. The data sheets record details in chronological order concerning the molding conditions, machining conditions, measuring conditions, sampling methods, and all other particulars of the manufacturing process. To achieve effective quality control it is essential that when the data are taken, the necessary process conditions are recorded, and the background history of the lot in question is made absolutely clear. With this background history, the data come alive and provide valuable inside information about way to improve. If no records of essential data are available or if the important points are not covered, it will be futile to prepare and look at histograms as they will not provide a clue for resolving problems. In this example, we have based ourselves on the results of a careful study with those concerned and decided to prepare a set of histograms for causal analysis by making a breakdown by lot for the material and a breakdown by machine for the machining process by concentrating our attention on the molding conditions.

Generally, the basic method for analyzing on the basis of a histogram consists, first, of drawing up the histogram and then of examining the distribution pattern. The next step is then to prepare a broken down histogram to determine how much the causes, by which the breakdown has been made, influence the variation. In this case, however, our aim is to track the causes by a breakdown of the factors immediately from the beginning so that it may be more convenient to prepare a table with the stratified frequencies first.

(1) Preparing a Table with Frequencies

Frequencies can be checked as shown in Table 1 by preparing a table with frequencies stratified into A_1 and A_2 for a breakdown by lot and a value table stratified into B_1 and B_2 for a breakdown by machine. When a broken-down histogram is prepared, it is laborious to establish a value table by dividing into convenient classes in accordance with standard procedures. Since, furthermore, the class boundaries and the representative values do not agree, the comparison of such stratified histograms will be inconvenient. For this reason, we can use the width of the classes found from the data in general. In this example, the number of data totalled 200, and the difference between the maximum and minimum values was 15 times the measurement unit. We therefore classified on the basis of the measurement data. Generally, in a comparison based on a differentiation or breakdown, the number of classes may reach even a figure of 20-fold.

(2) Preparing a Table with Stratified Histograms

Preparation of Fig. 1 (a), (b), (c) and (d) are examples of histograms based on a breakdown by lot and by machine. Fig. 2 (a), (b), (c) and (d) are historgrams prepared on the basis of a breakdown by a combination of lot and machine. These stratified histograms include the number of the data, the top scale line, and the bottom scale line. If graduations for the characteristic values on the x-axis (abscissa) will always be the same. Since the histogram has been established on the basis of a breakdown, the number of data is less than 50 so that there is much irregularity in the path. This means that the distribution pattern is difficult to assess. In this case, these histograms may be rewritten by changing the width of the class for these histograms.

Table 1 Stratified Frequency Table

Representative value for class	Lot A1 Machine			Lot A2 Machine			Total
	Machine B1	Machine B2	Sub total	Machine B1	Machine B2	Sub total	
1.90				/		1	1
1.91	/		1				1
1.92	/		1	/		1	2
1.93	/		1	//		2	3
1.94	卌 /		6	卌 ////		9	15
1.95	卌 卌	//	12	卌 卌 //	///	15	27
1.96	卌 /	/	7	卌 卌 //	卌	17	24
1.97	卌 //	/	8	卌 卌	卌 卌 /	21	29
1.98	卌 ///	///	11	///	卌 卌	13	24
1.99	卌 /	卌 //	13		卌 卌 ///	13	26
2.00	////	卌 卌 /	15		卌 //	7	22
2.01		卌 ///	8		/	1	9
2.02		卌 卌	10				10
2.03		卌	5				5
2.04		//	2				2
計			100			100	200

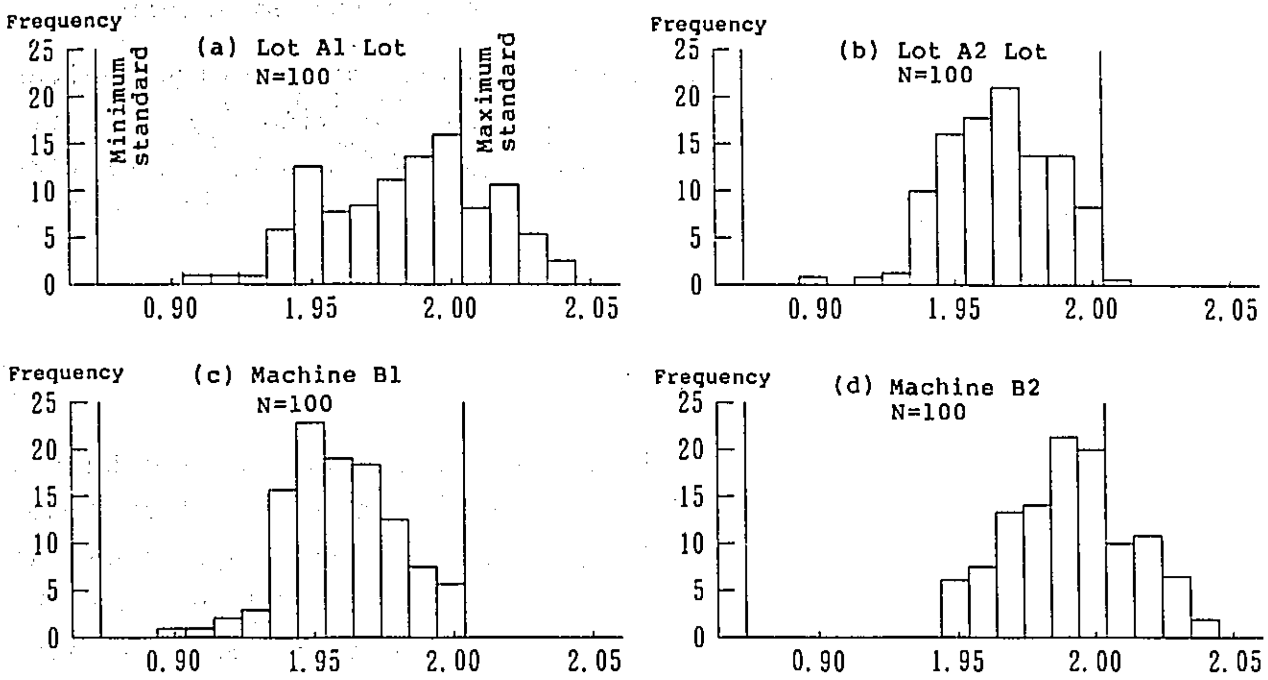


Fig. 1 Stratified Histogram with Breakdown by Lot and by Machine

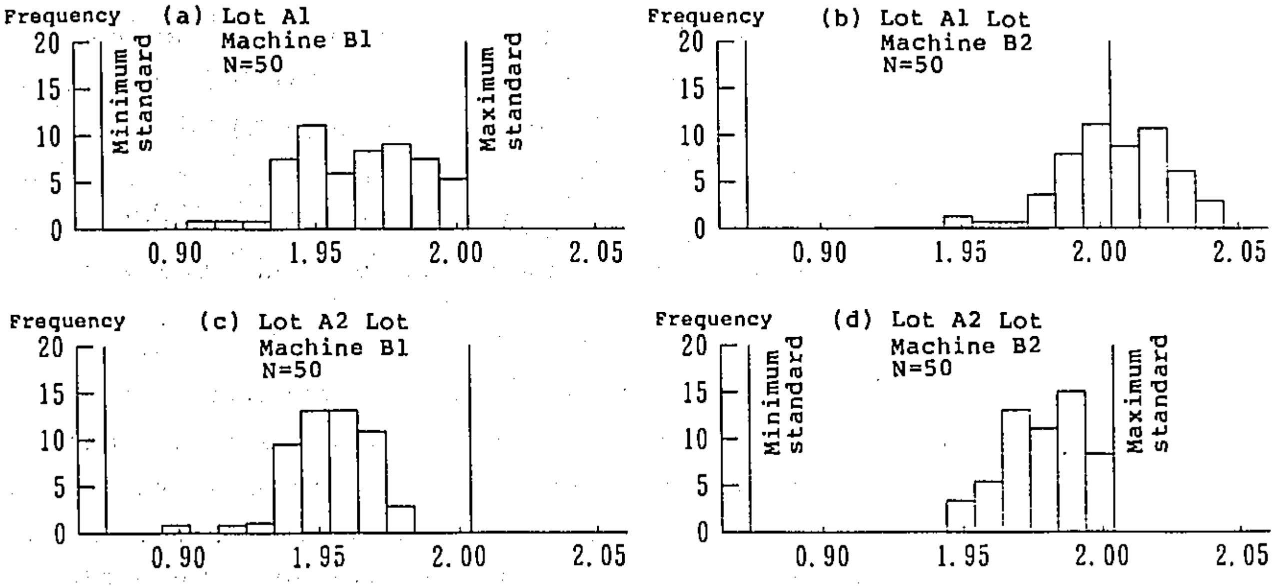


Fig. 2 Broken-down Histogram based on a Combination of Lot and Machine

(3) Establishing a total histograms

Fig. 3 is obtained by using the table of numerical values above (Table 1) as a basis for drawing up a total histograms. The average value (m) and standard deviation (s) can be calculated as follows:

$M = 1.9757$

$s = 0.0263$

(4) Examination

If we take the total distribution, it can be seen that a 13% defect level is found from the upper standard line. The shape of the distribution is that of a squashed-head comb. There is a clear need for a breakdown, and the fact that the distribution comes within ±3s indicates that there was nothing particular abnormal.

If we examine the broken-down histograms, it can be seen that, on the basis of lot, A2 shows little variation and would almost meet the standards with a little improvement, whereas A1 shows much variation and it is likely that the standards are deviated from even with the use of machine B1. It is necessary to examine the molding conditions properly to make some improvements. By machine, however, it can be seen that both B1 and B2 have roughly the same variation. In the case of B2, the dimensions tend to become a little too large and it is necessary to make some arrangements so that the average value changes.

From the histograms with a breakdown based on the combination of lot and machine, it can be seen that A1 and B2 gives the greatest frequency of defects (rejects). It can be recognized that this combination accounts for the greatest part of all rejects at present.. From Fig. 2 (c) it can be seen that A2 and B1 have some latitude with respect to the standard values and thus represent a favorable condition. The average value (m) and standard deviation (s) can be calculated as being:

m = 1.9540 and

s = 0.0156

Thus, the upper standard line runs at 3s from the average value.

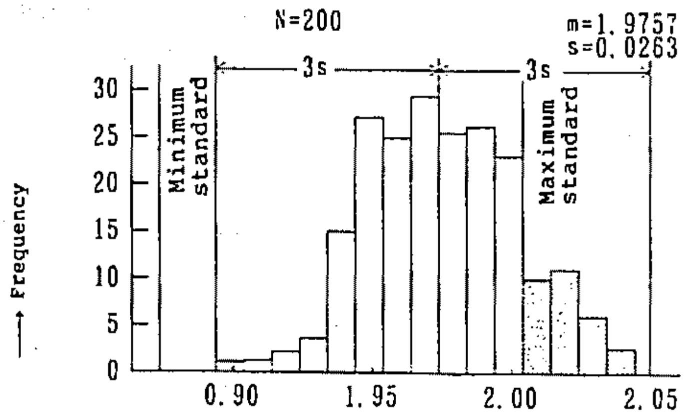


Fig. 3 Total Histogram

From, the broken-down histograms it can be clearly recognized that the factors that will increase the variation are the molding conditions and the machining conditions. A thorough examination of all aspects of the process made it possible to determine the causes. As a result it was possible to improve so that a condition similar to that of the A2 and B1 combination was achieved. Thus, even without the use of very sophisticated statistical procedures is it possible to tackle many practical problems in the factory and achieve improvements by simple breakdown or factor analysis techniques.

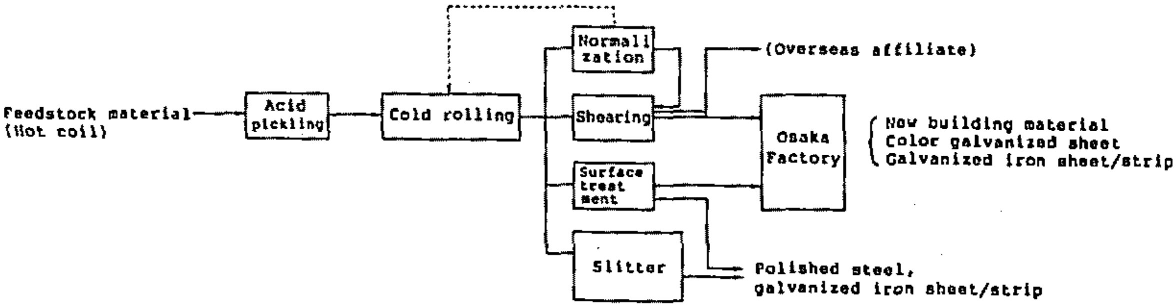
EXAMPLE 8 - REDUCING SHEAR DIMENSION DEFECTS

1. Preface

The factory concerned uses hot coil as the feedstock for cold rolling of specified thickness and width. Depending on the application purpose, the process may be performed in secondary stage. The product is a galvanized iron sheet/strip and polished steel strip for domestic and overseas sale.

In the shearing process after cold-rolling, the problem used to be that the sheared dimensions were incorrect with the use of the old shears. We have studied the background of these problems and tried to resolve them.

2. Outline of Process



3. Reasons for Dealing with the Problem

In the factory concerned, there are four shearing lines. One of these, is of the (old) up-cut shear type and the other three are of the (new) flying shear type.

The above up-cut shear type has a fixed shear arrangement. The shear dimensions are adjusted by using an photocell, and adjustment is a manual operation. This means that it produces a large number of off-size cuts (dimensional defects) since it has not automatic dimen-sions adjustment device similar to the flying shears. The result is that it leads to a poor yield and low product output. Thus, apart from the technical production problems it also has a bad influence on operator "morale." We have dealt with these problems with a view to resolving the difficulties.

4. Current Status of Inspection Procedures

4.1 Description of Equipment

When the coil has been rolled to the specified thickness and width, it is inserted in the coil holder of the shearing line to trim the sides to the final width with the side trimmer unit. It is finished with a leveler and sheared (cut) to the required length dimension by using a manually operated length-measuring unit. The cut sheet is stacked by having a prime piler for stacking the top-class material and a reject piler for the reject material. Once the pre-set quantity (weight) has been reached, the line is stopped so that the stack can be packed and transported. (See Fig. 1)

Fig. 2 shows the process. When the light beam shone from the photocell (2) is obstructed by the sheet material (8), the motor will start rotating, and the shear cutter (bottom blade) is activated to cut the sheet. As the line speed (that is, the speed at which the sheet travels in the line) increases, the cut length will become longer. To ensure that the sheet is cut to a constant length the line has to be adjusted so that the phtocell (2) moves to the left and right in a manner that matches the line speed.

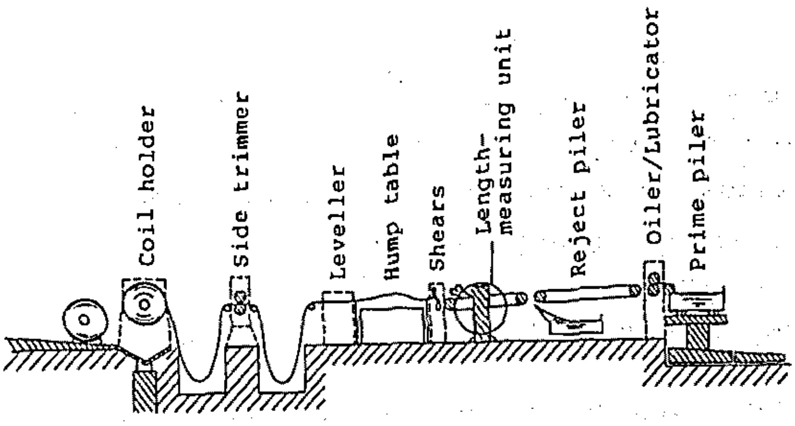


Fig. 1 No. 2 Shear Line (Up-Cut Shear Type)
(Simplified Schematic)

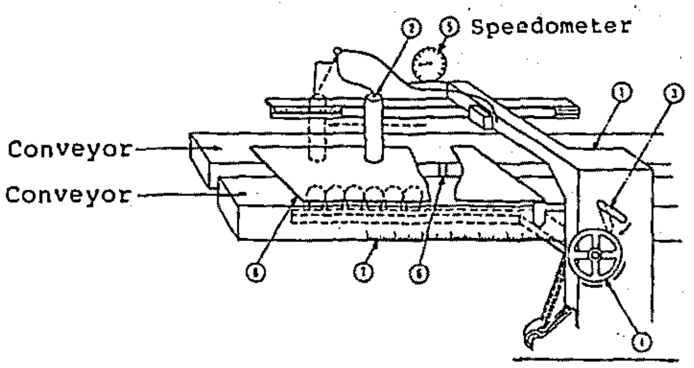


Fig. 2 Length-Measuring Unit

When the shearing operation is being performed, the leading edge ("head") of the sheet the operator checks whether the sheet is cut at the specified length while looking at the sheet's leading edge to observe whether it is exactly in the middle of the dimension marking (6). To raise the speed, the lever (3) is moved along the fine-adjustment divisions in order to increase the speed very gradually. At the same time, the photocell (2) also moves automatically to the predetermined position matching the speed (dotted line area). If, however, the speed increased above this position, the photocell will not be able to move any further so that the shear body (1) itself has to be moved by a manual turn of the handle (4) so that the sheet's leading edge (head) is exactly aligned with the marking when the sheet is being cut.

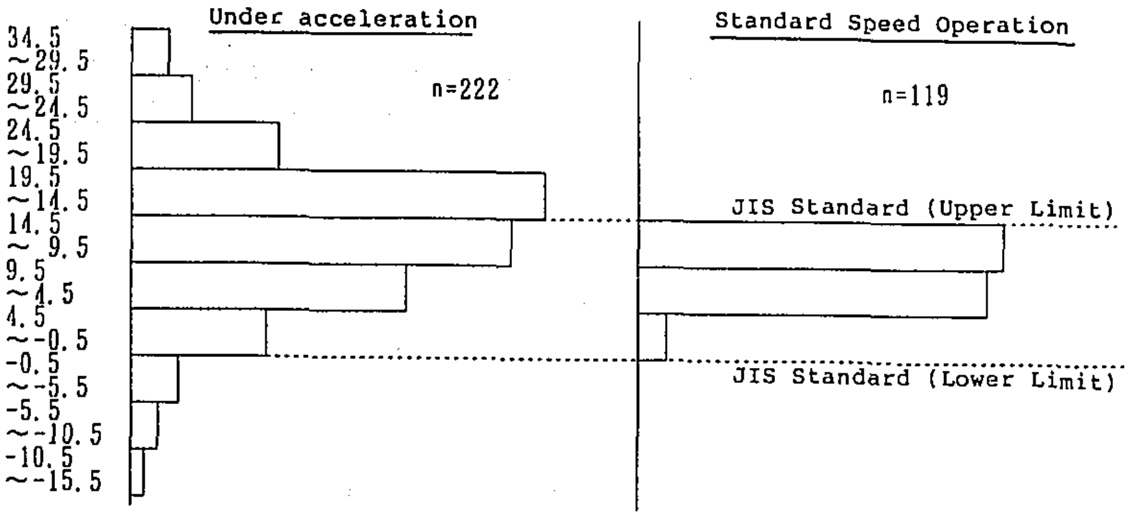


Fig. 3 Shearing Dimension Histogram

4.2 Analysis of the Current Process

The operators at the factory were questioned about production irregularities, and their comment indicated that there were practically no problem with off-size cuts at the normal (constant) speed. We therefore compared the production results achieved at normal speed with those obtained at accelerated speed. The results are shown in Fig. 3.

At the standard speed, production is, to all intents and purposes, within the specification limits. We knew, however, that, at accelerated speed off-size production reaches proportion of over 50%. This is the reason why we have on this occasion concentrated on a practical study of the process at accelerated speed.

To determine the causes of the failure (off-size) rate at accelerated line speed, we established a Causes and Effects Diagram in conjunction with the operators (Fig. 4). The most important of these factors are those related to the plant (electrical and mechanical). Since the improvement of the plant requires substantial investment costs, the plant-related factors have been ignored temporarily, so that within the scope of this study we have confined ourselves to considerations of dimensional defects (off-size problems) due to human differences and to variations in operating methods. We found that while details of the operating procedures are given in the instruction manuals kept at the plant, these instructions are too abstract, so that the manuals are not used and operation is performed on the basis of the operator's experience and "intuition." In our study, we chose a total of eight operators, four skilled and four unskilled ones, and had them repeat two or three operating cycles for us to study. The results were as given below. (Fig. 5)

(1) Dimensional variations with extreme instability both for the skilled and unskilled operators.

(2) Though we had expected some differences to emerge even with the skilled operators, the changes we found were far from being clear.

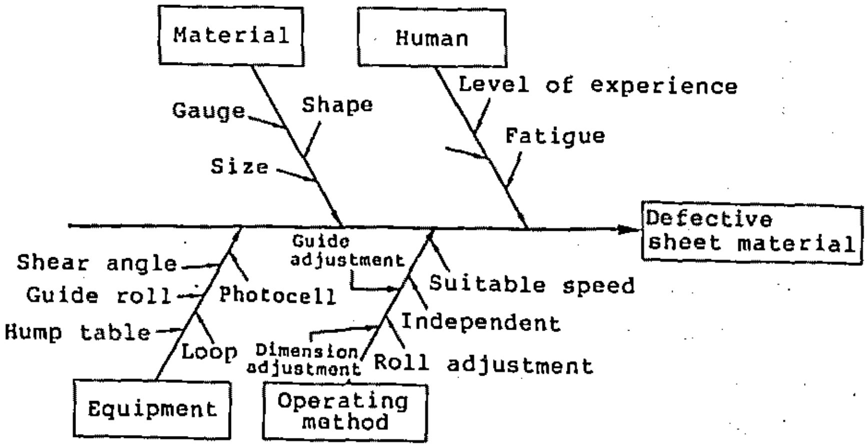


Fig. 4 Causes and Effects Diagram for Shearing Dimension Defects

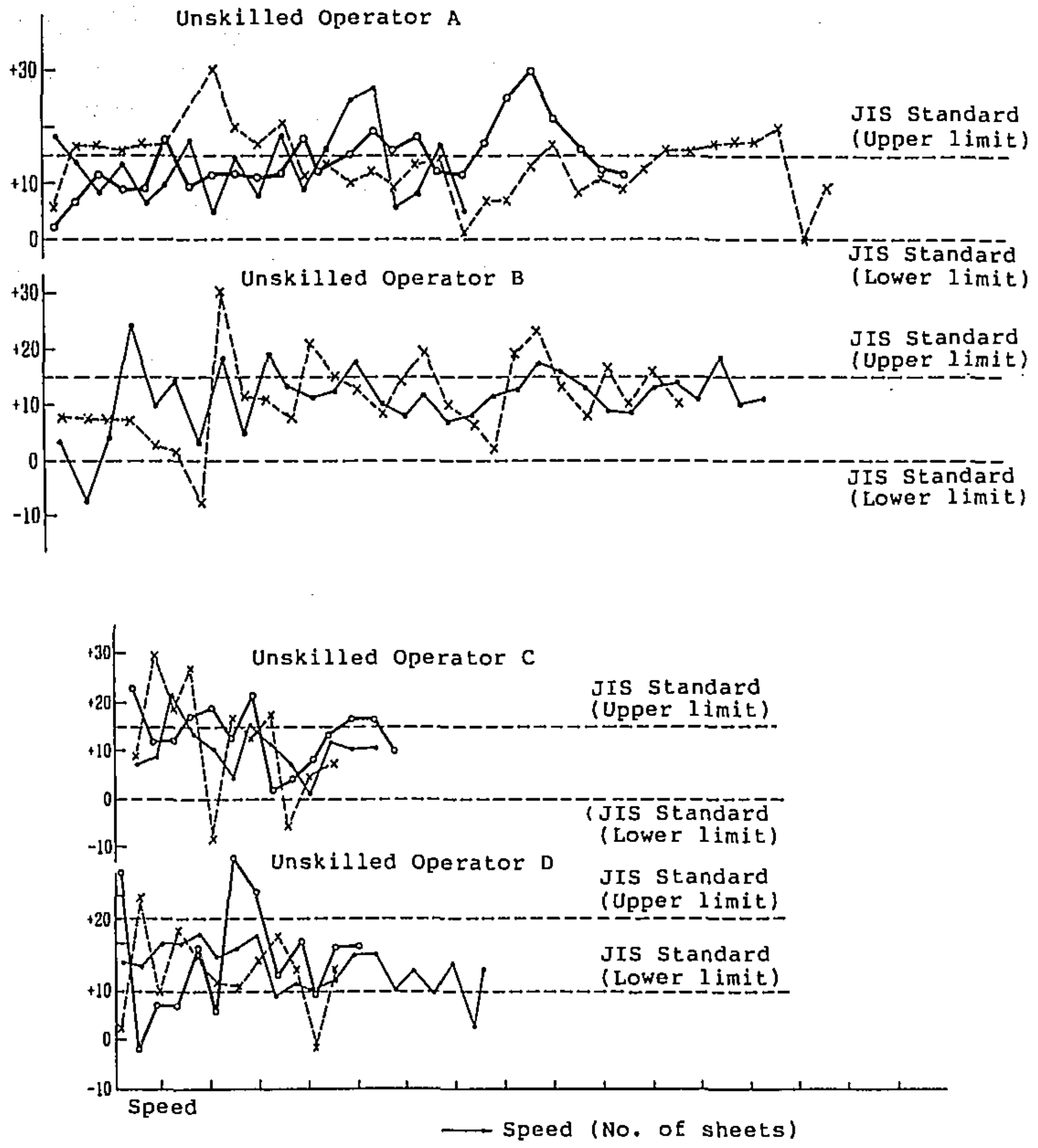


Fig. 5 Dimension Comparison Chart by Operator for Operation at Accelerated Speed

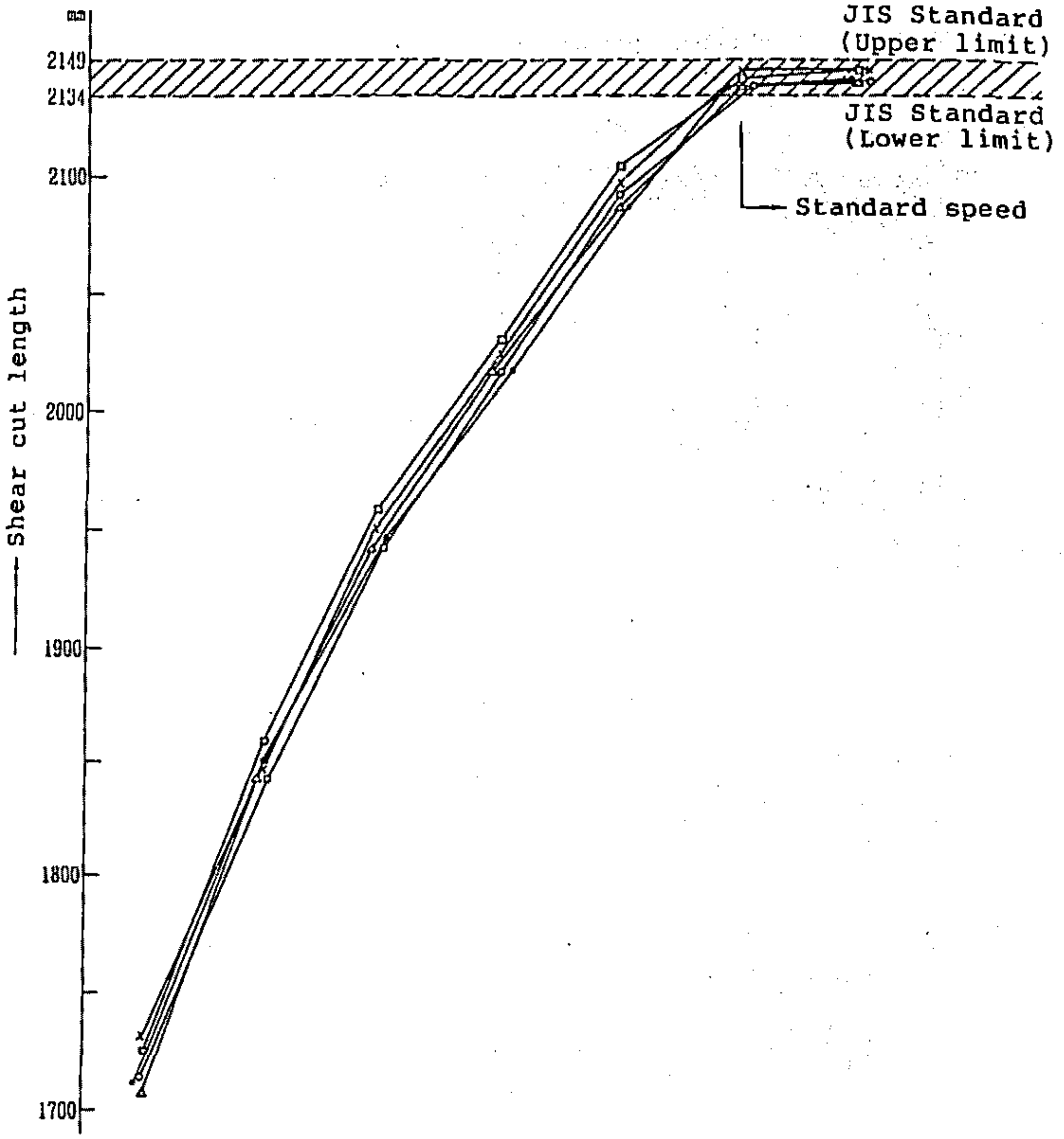


Fig. 6 Experiment 1

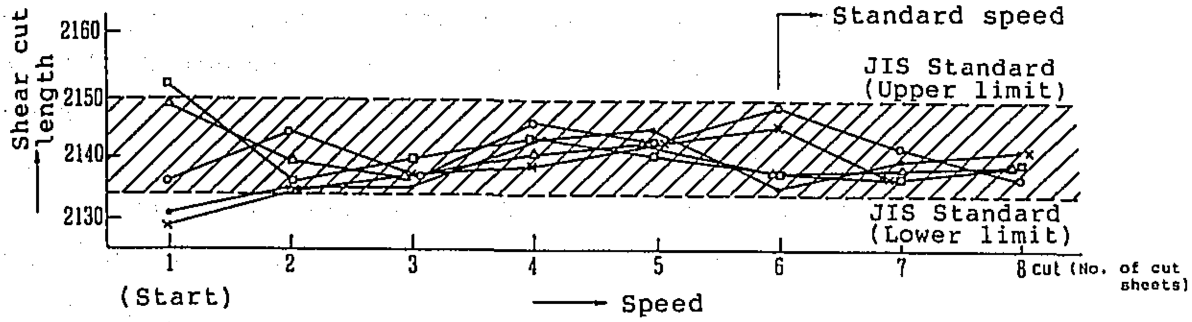


Fig. 7 Experiment 2

5. Countermeasures

The above results led us to reconsider further possibilities. First, there was the question whether it was possible to standardize the operating procedure. There was the other question as to whether it would be possible to minimize the manual operations (by mechanization). Eventually, we experimented in the following two directions.

Experiment 1

This procedure consists of fixing the photocell and shear frame at a particular location during normal speed operation and then increase the speed in a continuous manner.

Results

Since the line is set to a particular position at the standard speed, the sheet sizes cut initially at the start of operation are naturally much shorter than the specified dimensions, as can be seen in Fig. 6. As the process is continued, the standard speed is reached and the standard dimensions are gradually approached, the cut sizes fall within the specification limits.

At present, off-size production is being sold as reject products. If this method is used, however, the amount of reject grade that will be produced, will be five cuts, seeing that the standard speed is reached with the sixth cut (sixth sheet). This means that the reject grade volume will be much smaller than the current 12 cuts (2.5 x 6'). Yet, the dimension of off-size sheets produced with this method are far from the specification values so that they have to be scrapped down and are not saleable. We therefore have to consider the price difference between the reject product and scrap and ask which is more profitable. If this method is used, however, the following problems arise.

(1) Problems with the piling of the reject piler (The sheets stacked with the reject piler jam, they cannot be stacked smoothly and the line has to be stopped to repair the pile.)

(2) Problem of sorting reject from scrap.

(3) There is also a problem over work morale when scrap is produced deliberately.

Experiment 2

This method consists of fixing the photocell in a certain position during normal speed operation (Fig. 2, position of the dotted line) and determining the movement position of the shear frame by turning handle (4) to move the press.

Results

Based on the results of Experiment 1, we determined for the first, second, third cut, and so on, how close each cut was to the specified dimensions. We then used the opposite approach and set the position of the frame so to cut to the standard dimensions. (This meant that we did not fix the cutting position at the marking (6) but rather had the photocell of (2) fixed on the frame and proceeded by positioning only the frame. The results of this test are presented in Fig. 7.

6. Countermeasures

The operating standards/instructions should be amended. (Instead of abstract description, the instructions should be re-written in a practical, down-to-each manner.)

7. Effect

The proportion of off-size output at accelerated speed is currently around 66%. If this could be turned to top class product or prime sheet, the result would be an improvement worth around 1.06 million yen, if converted to corresponding financial effect. (When the effect is calculated, it is necessary to take the plant stoppages into account. Each time the line is stopped, it has to be operated at accelerated speed so that the effect of the above measures will vary somewhat in accordance with the frequency of the stoppages.

8. Future Development

(1) Mechanization of the method corresponding to experiment 2.

(2) Considering the possibility of replacing the up-cut shearing unit with a clearly superior flying shear type unit.

EXAMPLE 9 - REEXAMINATION OF THE WAY IN WHICH CONTROL CHARTS ARE PREPARED

1. Preface

In the system that recovers copper ammonia used as the carrier in the Bemberg production process, control charts have been used for many years as a means of supervising the process. The problem with these control charts is that they totally ignore the statistical evidence and only have a "target-monitoring function" designed to exert a psychological effect on the operators. They have thus no more than a mere recording value. This has led to a re-appraisal of the way in which control charts are currently being prepared so as to allow their use for proper process control and analysis. As a result, improvement schemes have been implemented for the various process control purposes.

2. Description of Process

The Bemberg factory produce the Bemberg yarn used for making women's underwear and the lining material for men's top wear. Copper ammonia is employed as the carrier in the spinning process. The copper ammonia is discharged as a component of the waste water discharged from the yarn produced in the process. This copper ammonia is recovered in the system we are reviewing here, and the recovered copper ammonia is used again. For this reason, it is essential:

(1) to raise the unit requirement of copper and ammonia

(2) to lay down basic standards for the environment in connection with the factory waste waters

to recover the copper and ammonia from the process for recycling.

3. Present Manner of Preparation of Control Charts

(1) The Control Charts are x Control Charts in all. The control points they cover are as follows:

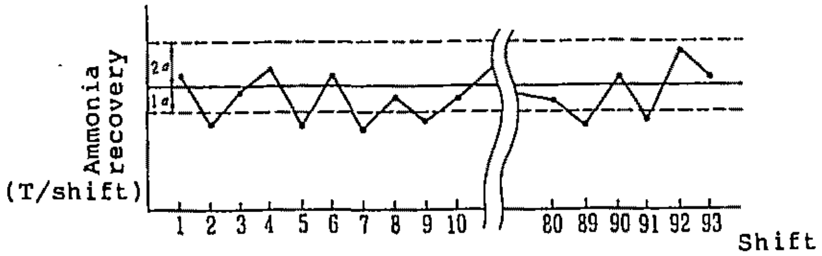
1)	Quality standards	14 (23%)
2)	Unit source	8 (13%)
3)	Plant operating data	38 (64%)

(2) Dubious Points concerning the Control Charts

1) Shift vs. production plots
2) Limit line for control using sigma
3) Adopting a control range to correspond to the standard values.

(3) Action if points appear outside the above control limit.

Example 1 shows a method for preparing control charts to control the amount of ammonia that is recovered.



Example 1 Preparation of Control Chart

Let us calculate x and σ by using the histogram method.

$$\overline{x} = \frac{\Sigma \overline{x}_i \ f_i}{\Sigma f_i}$$

whereas: x_i :

Measured value
(Median value) $\overline{x}$

Frequency fi	Median value xi
8	3.0
10	2.8
25	2.6
23	2.4
16	2.2
3	2.0

fi: Frequency

$$\sigma = \sqrt{\frac{\Sigma f_i x_i^2 - \frac{(\Sigma f_i x_i)^2}{\Sigma f_i}}{\Sigma f_i}}$$

The control range has been determined as follows.

When x is to be raised .... increase to the upper limit.
When x is to be lowered ... decrease to the lowest limit.
When x is to be kept ...... set the range so it is equal to the upper and lower limits.

4. Problem Areas

(1) These data do not add up to being suitable materials to form the basis for process analysis.

(2) These results do not represent usable data for a stable control of the process.

(3) In view of the large number of process charts, they may distract the shift-workers' attention because of their complexity.

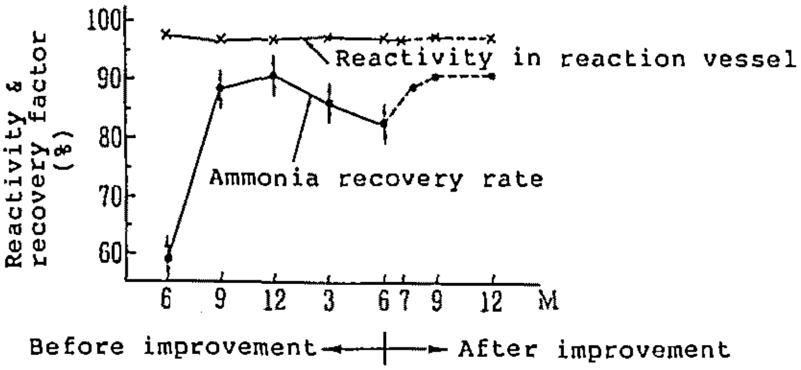
As a result,

(1) All that is done is to take and record the data without using them.

(2) They make the operator's reaction and response insensitive if any abnormal value is found.

This accounts for the fact that despite the availability of the data, the discrepancies in the process still persist. (See Example 2)

Although the reactivity is near-100%, (A) the recovery efficiency for ammonia is very low. The loss factor for process (A) is approximately 12%. In the following month, that is, in December, the recovery factor was raised to 94%. This achievement is substantiated by technical evidence and problems are believed to exist with process control.



Example 2 Overview of Process (A) Control

5. Approach to Introducing Improvements

(1) Benefits derived from improvements

(2) Providing statistical evidence

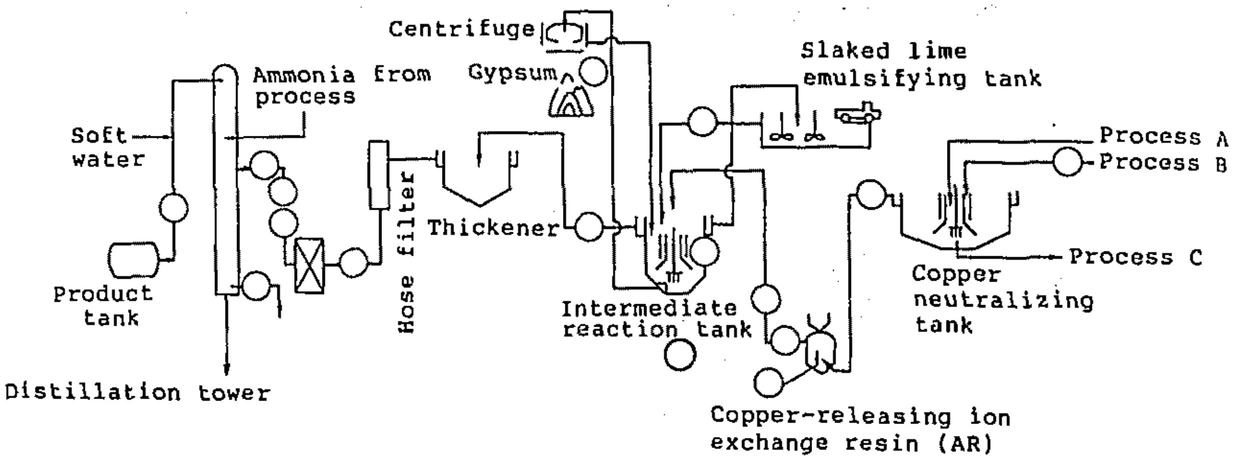
(3) Narrowing down the items to be included in the control charts

6. Range for the Targeted Improvements

This process stage takes care of the recovery of copper and ammonia. First, we approached the problem by confining ourselves with the ammonia recovery process (referred to as process (A)). Fig. 1 shows the flowsheet for this process.

Process (A) consists of decomposing the ammonium sulfate in slaked lime to obtain dilute ammonium hydroxide which is concentrated in the distillation tower to obtain the ammonia product.

This process uses a 14-item x-Control System in which the controlled items are shown in encircled figures. The problems areas are the same here as those previously discussed.



Control chart No.	Item
(1)	Copper neutralizing tank Copper 0.F concentration
(2)	AR treatment acqueous copper solution concentration
(3)	Ammonium sulfate concentration
(4)	Recycled CaO concentration
(5)	Ammonium sulfate concentration
(6)	Slaked lime concentration
(7)	Gypsum hydrolysis
(8)	Non-dissolved calcium concentration
(9)	Non-dissolved calcium concentration
(10)	Distillation tower feed concentration
(11)	Distillation tower feed rate
(12)	Ammonia discharged from container
(13)	Product ammonia quantity
(14)	Dilute acid concentration
(15)	Ammonia loss rate in neutralization reaction tank
(16)	Ammonium sulfate input

Fig. 1 Process (A) Flowchart

7. Improvement Methods

(1) Benefit to be Derived from Improving (Anticipated Benefit Arising after Reexamining the Control of Process (A))

Feedstock ammonia 3.20T/shift (with a reactivity of 99%)

Actual amount of recovered ammonia $\frac{2.81T/shift}{0.39T/shift}$

0.39T/shift x 90 shifts/M x 23K¥/T x 12M/Y = 9.685¥/Y

(2) Statistical Evidence

Replacing the x-Control Chart by an x-Rs control chart or an $\bar{X}$-R control chart

1) If taken with σ , the variation is too great and the risk β also too great, because, compared with the $\bar{X}$-R method, it is clear that with the method, we have an increase only to the extent of change within the same class. (See Example 3.)

2) If taken with 2 σ , the risk α is too high.

3) Haste action, however, leads to the opposite risk that hunting may easily occur. (See Example 4.)

(3) Lowering the Number of Target Items in the Control Chart

1) Extracting those items which are likely to have a great influence in the Pareto Chart (See Example 5.)

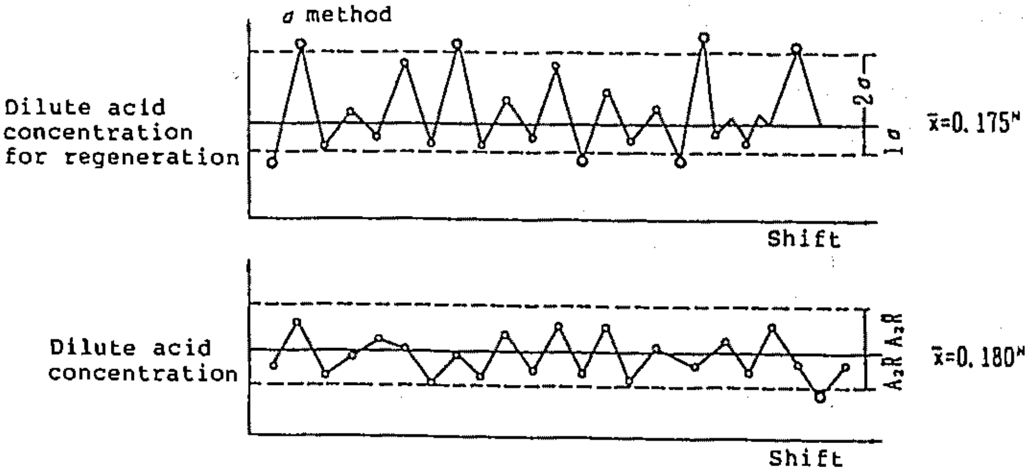
2) Work procedures and graphs are used instead of control charts. Wherever possible, only those items for which action is possible should be treated as factors.

Example 3 Comparison of Variations with the σ Method and x-R Method

Present condition	(A) Ammonia recovery rate in July after the improvements
σ Method	$\bar{X}$-R control chart (Chart with stratification of data)
3 σ = 3 x 3.03 = 9.09kg	A_2R = 4.04kg

$3\sigma > A_2R$

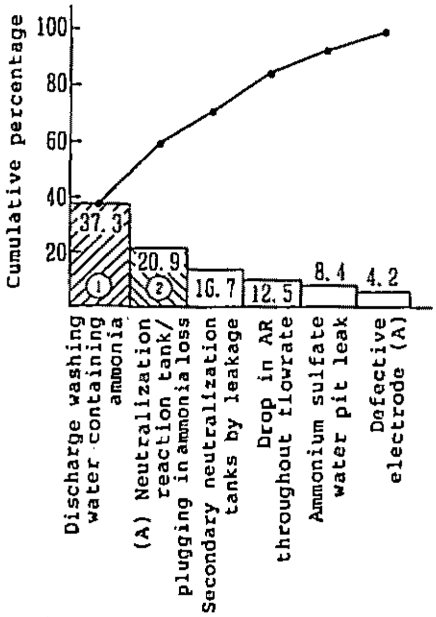
Example 4 Comparison of Variations by Action



Control Chart used for controlling processes consisting of two system, with one system being handled by the σ method and the other system by the $\bar{x}$-R system.

Example 5 Pareto Chart Giving Factors Pertaining the Ammonia Recovery (Process (A))

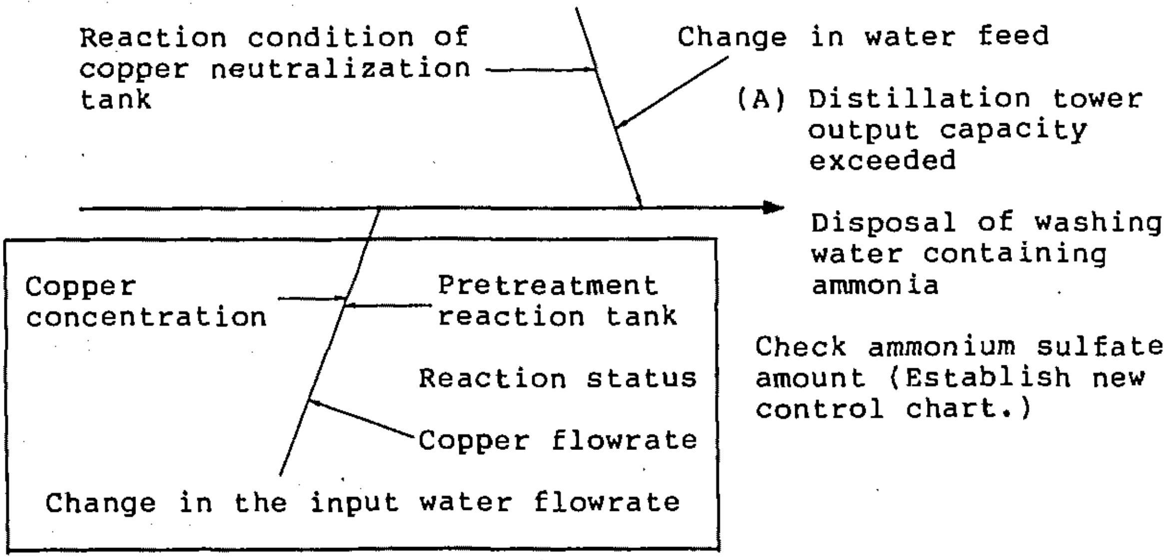
Factors pertaining to the 500kg/shift reduction in ammonia recovery in a period of 3 months



(1) Reduction in the ammonia concentration in neutralization reaction tank (A)

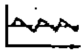
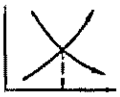
(2) Ammonia loss factor in neutralization reaction tank (Process A)

Ancillary plant measurement equipment indicates the defect rate in terms of breakdown/congestion.



Check ammonium sulfate amount (Establish new control chart.)

8. Improvement Items

Items abandoned from the control chart	(3)	Correlation with the characteristic value for the previous process (16)
	(6)	Operation standard: Liquid level control Tank volume (Before)  Constant, raw material purity held constant, specifying the number of transport vehicles (After) 
	(5)	No efficient use of data Little value as factors for actions to be taken
	(9)	Correlation with (8)
	12)	Standardization of operation: Extracting the optimum conditions by experiment planning techniques 
Items altered	(7)	Pn Control Chart - No meaning even if a value above the standard value applies
New items	(16)	Amount of input ammonium sulfate from Process B. Swift action from (3)
	(15)	Ammonia loss factor for neutralization tank (Process (A)). Pn Control Chart for other ancillary plant used for process analysis

9. Results of Improvement

(1) All parts of the process were analyzed using a Control Chart, with x gradually approaching the standard value. As a result of this, the ammonia recovery rate (i.e., recovery efficiency) (A) was maintained at 90% for the three months following the start of this method in July. (See Example 2)

(2) Increased Reliability for Control Chart

(3) Thanks to the establishment of a Control Chart and the division of tasks for the analysis, a clear definition of responsibility has been achieved. This makes itself felt in the Process Control.

10. Summary and Conclusion

The purpose of reexamining the Control Chart was originally to improve the use of Control Charts for Process Control and Analysis and to stabilize the process. As a result, it has been possible to increase the ammonia recovery and reach the waste water standards. In the future, we intend to apply this improvement method to other ammonia processes and to the copper recovery.

EXAMPLE 10 - PREVENTING CRACK FORMATION IN LADLE BRICK CALCINATION

1. Preface

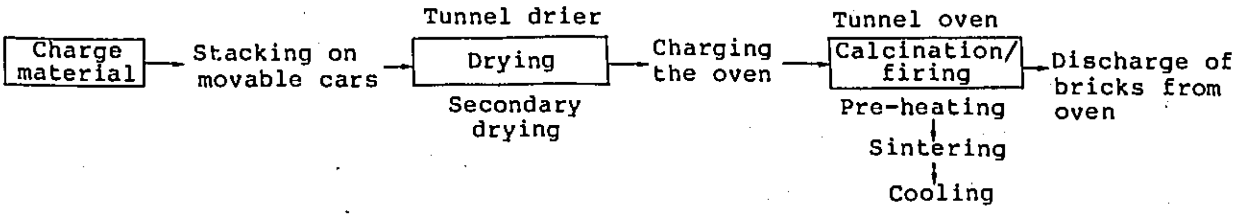
The main product of this factory is refractory bricks for steel-making.

Roughly 40% of the production consists of ladle bricks, and this proportion is likely to rise even further in the future.

2. Reason for Selecting the Present Theme

The problem of crack formation in ladle bricks occurring in the firing process has been highlighted for the reason that the calcination process leads to the highest incidence of defects. This is the final stage in the production of ladle bricks, and roughly 70% of all bricks made in this calcination stage have cracks so that it is vitally important to take urgent action to improve the process.

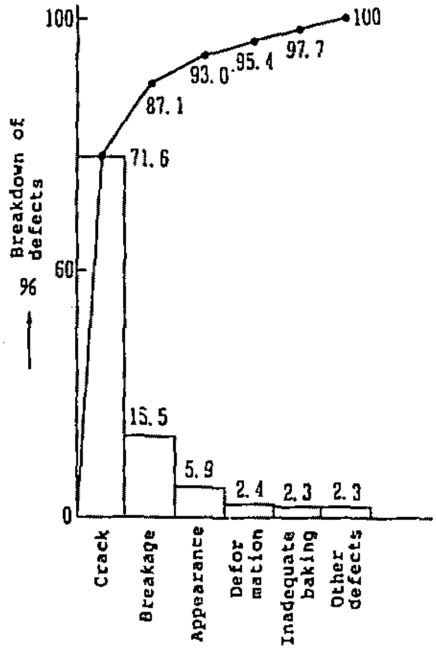
3. Outline of the Clacination Process in a Tunnel Oven



4. Analysis of the Current Situation

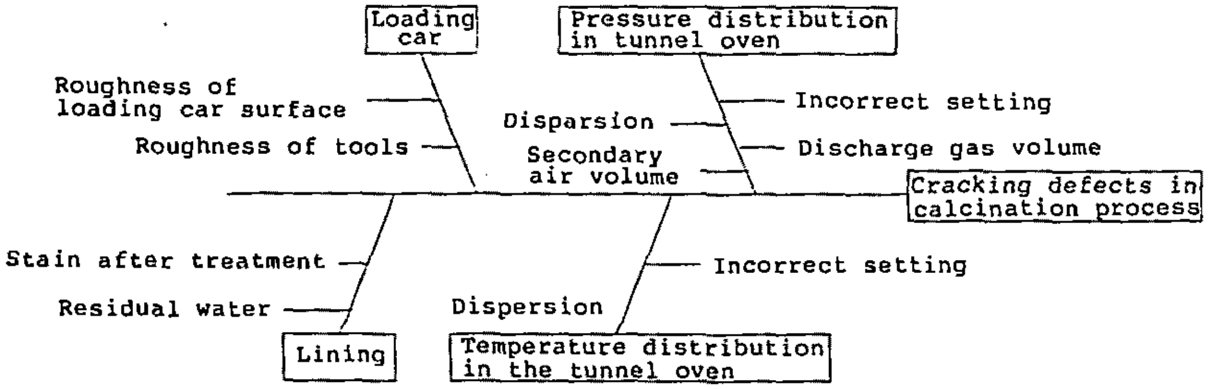
4.1 Establishing a Percentage Rate (PARETO) Graph

From the data for the last three months, we have prepared a pareto graph for each particular defect.



Pareto Rate Graph with Breakdown of Defects
Survey of Present Status)

4.2 Checking the Problem Areas in the Calcination (Firing) Process of the Bricks in the Tunnel Oven on the Basis of a Cause and Effect Diagram



Cause and Effect Diagram

5. Experiment

5.1 Factor Determination

A technical investigation was carried out to determine the causes of crack formation on the basis of a Cause and Effect Diagram. The results indicated a need for re-examining the temperature settings in the kiln.

5.2 Experimental Method

5.2.1 Temperature Measurement

(1) Measuring Devices

Temperature measurement was performed with a platinum - platinum rhodium (13%) thermocouple and recorded, within a 5°C accuracy, with an electronic tube type temperature self-recording device.

(2) Measuring Intervals

Taken as measuring points were ten locations considered important in the oven and the temperature measurements were repeated at 80 minute intervals (this corresponds to the cycle time at which the bricks are charged with the loading car).

5.2.2 Data on Crack Defects

Brick materials of the same type and same shape were loaded onto the 50 charging cars by the same stacking method, and the rate at which cracks formed was checked for each charging car.

Note: Crack defect rate = Number of crack defects/
Total number x 100(%)

(Example of calculation)

(1) Data

Crack Defect Data by E Section Temperature and Charging Car

No.	Temeperature x (℃)	Defect rate y (%)	No.	Temperature x (℃)	Defect rate y (%)
1	585	1.42	26	590	3.54
2	585	2.87	27	585	3.75
3	590	2.75	28	590	2.50
4	595	2.12	29	595	2.62
5	595	1.07	30	600	0.67
6	600	0.00	31	605	1.00
7	600	1.75	32	610	2.49
8	605	1.40	33	615	1.20
9	600	2.34	34	615	0.00
10	595	1.72	35	620	0.92
11	595	3.39	36	620	0.25
12	590	1.75	37	615	0.66
13	585	2.31	38	615	1.50
14	580	4.38	39	610	0.00
15	580	2.20	40	610	1.42
16	580	3.00	41	605	0.21
17	575	4.55	42	610	0.45
18	570	2.50	43	605	1.67
19	575	3.50	44	600	1.32
20	570	4.23	45	600	0.88
21	575	4.03	46	595	0.84
22	585	1.76	47	590	2.26
23	580	1.72	48	595	1.87
24	580	4.38	49	600	1.92
25	590	0.90	50	605	2.85

The extent of crack formation in the bricks was considered only in terms of number of defective products (bricks). And the problem of multiple crack formation in any one brick was ignored.

5.2.3 Relating the Temperature in each Part of the Oven with the Defect Rate per Charging Car

The relationship was established between the crack formation rate per charging car and the measured temperature value for the charging car passing through the set measurement locations.

5.3 Analysis of the Correlation between the Temperature in each Part of the Oven and the Crack Defect Rate

The correlation factor for the temperature values measured in each part of the oven and the corresponding crack defect rate was calculated. The results of these calculation are as follows.

Temperature measuring point	A	B	C	D	E	F	G	H	I	J
Correlation factor (γ)	0.18	0.26	−0.21	−0.15	−0.73	0.22	−0.06	0.07	0.14	0.27

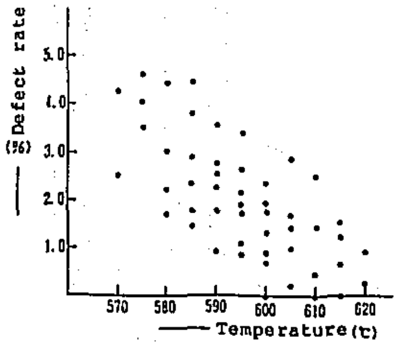
As a result of the calculations, it was recognized that the strongest correlation applies to the relationship between the temperature in section E and the crack defect rate in this section.

(Calculation)

$$S_u = 341 - \frac{9}{50} = 340.82$$

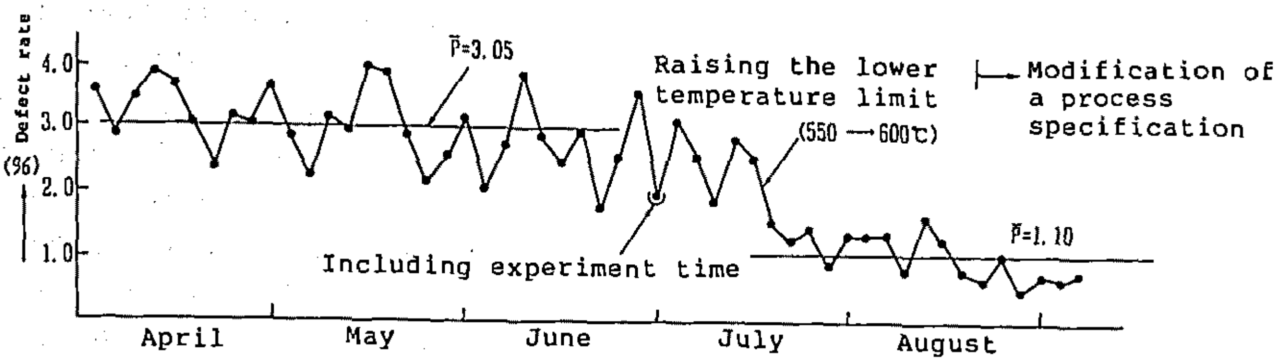
$$S_v = 317 - \frac{625}{50} = 304.50$$

$$S_{uv} = -234 - \frac{3 \times (-25)}{50} = -235.5$$



Distribution Chart

(2) Calculation Using a Two-Dimensions Frequency Table



Variation in Crack Formation Rate with Time

(Calculation Sheet)

	Typical values	0 ~0.49 0.245	0.50 ~0.99 0.745	1.00 ~1.49 1.245	1.50 ~1.99 1.745	2.00 ~2.49 2.245	2.50 ~2.99 2.745	3.00 ~3.49 3.245	3.50 ~3.99 3.745	4.00 ~4.49 4.245	4.50 ~4.99 4.745	f(v)	vf(v)	v²f(v)	Vu	vVu
Typical values		−4	−3	−2	−1	0	1	2	3	4	5					
570	−5						/ 1			/ 1		2	−10	50	5	−25
575	−4								/ 1	/ 1	/ 1	3	−12	48	12	−48
580	−3				/ 1	/ 1		/ 1		/ 1		4	−12	36	5	−15
585	−2			/ 1	/ 1	/ 1	/ 1		/ 1	/ 1		6	−12	24	5	−10
590	−1		/ 1		/ 1	/ 1	// 2		/ 1			6	−6	6	1	−1
595	0		/ 1	/ 1	// 2	/ 1	/ 1	/ 1				7	0	0	−4	0
600	1	/ 1	// 2	/ 1	// 2	/ 1						7	7	7	−14	−14
605	2	/ 1		// 2	/ 1		/ 1					5	10	20	−8	−16
610	3	// 2		/ 1		/ 1						4	12	36	−10	−30
615	4	/ 1	/ 1	/ 1	/ 1							4	16	64	−10	−40
620	5	/ 1	/ 1									2	10	50	−7	−35
f(γ)		6	6	7	9	6	6	2	3	4	1	50	3	341	−25	−234
Vf (γ)		−24	−18	−14	−9	0	6	4	9	16	5	−25				
u²f (u)		96	54	28	9	0	6	8	27	64	25	317				
Uv		18	10	10	2	−2	−7	−3	−7	−14	−4	3				
VUv		−72	−30	20	−2	0	−7	−6	−21	−56	−20	−234				

Correlation factor $\gamma = \frac{S_{xy}}{\sqrt{S_x \ S_y}} = \frac{S_{uv}}{\sqrt{S_u \ S_v}} = \frac{-235.5}{\sqrt{340.82 \times 304.50}} = -0.73$

$$\gamma \ (n-2, 0.05) = \frac{1.960}{\sqrt{48+1}} = 0.28$$

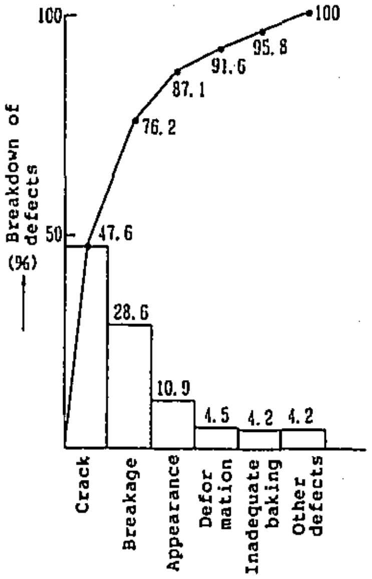
$$\gamma \ (n-2, 0.01) = \frac{2.576}{\sqrt{48+3}} = 0.36$$

The result indicates that $|\gamma|$ = 0.73 > γ (50-2, 0.01) applies and that there is a correlation at a Danger Rate of 1%.

6. Results

The above experiments led to the conclusion that the temperature in section E does exercise an influence on the incidence of crack formation. In the conventional operating practice for the calcination oven, the target temperature in this part of the oven was set on the basis that the lower temperature limit for Section E was 550°C. When this limit was raised to 600°C and the oven operated on an experimental basis for about one month with this temperature setting, it was found that the crack defect rate dropped by about 2%.

On the basis of this finding, the process specification for tunnel kiln operation were corrected. The result has been a 1.5 - 2.0% improvement in yield.



Pareto Chart of Defects
(Survey after Improvement)

7. Future Problem Areas

It has thus been established that considerable improvements can be made by altering the temperature settings. But apart from this, there is still much room left for further improvement. At present, the possibilities have not yet been exhausted to establish optimum conditions.

While there will also be a need to carry out experiments at high temperatures, this does present some difficulties with the present equipment. For the future, research studies will be required on the various aspects of building up the kiln and its design to achieve further improvements.

7. Reference list

ATTACHMENT 4

LIST OF DATA COLLECTED BY THE STUDY TEAM

NO.	from	Title of Collected Data	Languag
1	SICE	Suplemento Estadistico Mensual No. 49	S
2	SICE	Boltin de Comercio Exterior Argentina Actas, Protocolos y Anexos del Programa de Cooperacion e Integracion entre Argentina y Brasil	S
3	SICE	Revista Pyme- Informacion Tecnologia	S
4	SICE	Funciones y areas de trabajo	S
5	CIFARA	Industria Automotriz Argentina 1987	S
6	CIFARA	Industria Automotriz Argentina - La Proxima Decada	S
7	CIFARA	Produccion y Ventas de Automotores - 1988	S
8	SICE	Guia de Servicios, Ensayos y Analisis	S
9	SICE	Analisis Estadistico Publicaiones Tecnicas	S
10	INTI	Centro de Investigacion Tecnologica para la Industria Plastica	S
11		Centro de Investigaciones Textiles	S
12	SICE	Argentine's Legal Frame Work	E
13	YPF	Oferta de Tecnologia Investigacion y Desarrollo	S
14	SICE	Potencial Productivo de las Pyme: indentificacion de sectores industriales	S
15	CIFARA	Indexport Automotriz Argentina	S
16	ITEFA	Laboratorio de Ensayos Ambientales	S
17	CNEA	Servicio de Asistencia Tecnica a la Industria	S
18		Argentina 2000	S
19		Argentina Hacia un Nuevo Ordenamiento Territorial	S
20	UIA	Anuario 1988(Union Industrial Argentina)	S
21	INTI	Registro de Transferencia de Technologia	S
22	SICE	Sistema de Informacion Comercial Computarizado	S

NO.	from	Title of Collected Data	Languag
23	ADELCO	El Ojo del Consumidor 1988/2,3,8,9,11	S
24	ADELCO	El Ojo del Consumidor 1989/4,5,6,7	S
25		Fichero de Exportadores Argentinos	S
26	IRAM	Reglamento de Estudio de Normas y del Funcio Namiento de sus Organis mos Tecnicos	S
27	IRAM	Estaturo Social	S
28	IRAM	Sello IRAM de Conformidad con Norma IRAM	S
29	IRAM	" " para Servicio	S
30	IRAM	Marca IRAM de Segridad	S
31	IRAM	Plan de Estudio de Normas IRAM	S
32	IRAM	Dinamica IRAM	S
33	IRAM	Guia de Licenciatarios del Sello IRAM y Servicios Afines	S
34		Boletin Oficial	S
35		Brochure - Primer Semanario de Comercio Exterior y Cambios	S
36		Gaceta Laboral 99	S
37		Gaceta Impositiva 160	S
38	UIA	Boletin del Departamento de Comercio	S
39	ADELCO	Ensayos Comparativos de Calidad	S
40	IRAM	Instituto Argentino de Racionalizacion de Materiales	S
41		Industria Automotriz Argentina 1980	S
42		Industria Automotriz Argentina 1985	S
43		Clasificacion de las Enpresas de Autopiezas Segun Tamano	S
44		Legal Regulations for Car Manufacture in Argentina	E

NO.	from	Title of Collected Data	Languag
45	ADEFA	Produccion y Ventas de Automotores 1988	S
46	ADEFA	Informacion de Prensa	S
47		Situacion General	S
48		Facultad de Ciencias Ecnomicas	S
49	FIEL	Indicadores de Coyuntura No. 280	S
50	FIEL	Resena 1988 de la Actividad Economica (Indicadores de Coyuntura)	S
51		Actitudes Hacia la Calidad de Bienes y Servicios en la Argentina	S
52		Investigacion exploratoria de la significacion y las actitudes hacia la Calidad de bienes y servicios en la Republica Argentina	S
53	SiGEP	Precios y Tarifas de las Empresas Publicas 1988	S
54		" " Primer Trimestre 1989	S
55		" " Segundo Trimestre 1989	S
56		" " Primer Trimestre 1987	S
57		" " Segundo Trimestre 1987	S
58		" " Tercer Trimestre 1987	S
59		" " Quarto Trimestre 1987	S
60	INDEC	Encuesta de gastos e ingresos de los hogares	S
61	INDEC	La pobreza en el conurbano bonaerense	S
62		Guia Practica del Exportador e Importador 391	S
63		Guia Practica del Exportador e Importador 390	S
64		Guia Practica de las Exportaciones Promocionadas Argentinas	
65		Member Firms which exported over US$1Million in 1984	E
66		Economia en tiempos de CRISIS	S
67	INDEC	Boletin Estadistico Trimestral 10-12 1988	S
68	INDEC	Industria Manufacturera Resultados Definitivos Primera Etapa	S

NO.	from	Title of Collected Data	Langua
69		Resume Mr. Ing.Ricardo Werber	S
70		Directorio de Exportacion de Cordoba 1988/89	S
71		Memoria y Balance General 1987(Banco Nacional de Desarrollo Argentina)	S
72		Revista Pyme, Comercio Exterior	S
73	BANADE	Lineas de Credito	S
74		Mercado del Automovil	S
75		Anuario Estadistico 1986-87	S
76		Quarto Seminario de Calidad y Productividad por Carlos S. Menem	S
77		La Revolucion Productiva for Moises IKONICOFF	S
78		De la Cultura de Renta a la Economia de Produccion	S
79		Discurso del Presidente de la Nacion en la cena del dia de la Industria	S
80		Plan de Reforma Economica	S
81		Recuperar la Estabilidad, Asgurar el crecimiento y Promover la Equidad	S
82		Comunicado de prensa Informacion No. 5/89	S
83		Comunicado de prensa 470	S
84		Principales Medidas Economicas del 9.07.89	S
85		Conferencia de Prensa del Ministro de Economia, Juan Vital Sourrouille, para Anuncia el Plan Anti-Inflacionario	S
86	BCRA	Memoria Anual (BCRA) 1984/5/6	S
87	BCRA	Balance of Deposits/Loan by Financial Institutions	S
88	BCRA	Estimaciones Trimestrales sobre Oferta y Demanda Global	S

NO. from	Title of Collected Data	Languag
89 BCRA	Balance Sheet of BCRA	S
90 BCRA	Regimenes Crediticios Especiales	S
91 Segba	Tariffs 1987/7/14	S
92 UBA	1988 Guia del estudiante	S
93	La industria Argentina: desarrollo y combios estructurales	S

NOTE: E: ENGLISH LANGUAGE
S: SPANISH LANGUAGE

ATTACHMENT 8

MEMBER LIST OF THE STUDY TEAM

NAME	ASSIGNMENT
Mr.Teruo TAKESHITA	Team Leader
Mr.Kanji KAKINUMA	Sub-leader & Certification system
Mr.Takao IKEDA	Sub-leader & Export promotion policy
Miss.Sonoe YAMADA	Small/medium industries development
Mr.Yasushi NAKAMURA	Business administration/management
Mr.Tsutomu TAYAMA	Market Analysis
Mr.Tsuyoshi ENDO	Total quality control (mechanical)
Mr.Yasuhiko HOSOE	Total quality control (mechanical)
Mr.Yoichi MIYAMURA	Total quality control (electro-mechanical)
Mr.Hiroshi TOGO	Total quality control (electro-mechanical)
Mr.Kazuya KUSAKABE	Diffusion of total quality control
Mr.Katsuhisa NAGAI	Certification system
Mr.Tsuneo NAKAGOMI	Total quality control (mechanical)
Mr.Tosio SANO	Total quality control (electro-machanical)

ATTACHMENT 9

COUNTERPART MEMBER LIST

NAME	ASSIGNMENT
Ing. Silvia Veitzman	Coordinador
Ministro Carlos Fasciolo	Promocion de Exportaciones
Lic. Nora Schapira	Sistemas de Certificacion Coordinadora
Srta. Lidia Bontorin	Sistemas de Certificacion
Ing. Alejandra Comba	Autopartes Coordinadora del grupo empresario
Sr. Jorge L. Riccombeni	Promocion de Exportaciones

ATTACHMENT 10. INSTITUTES AND FIRMS VISITED BY STUDY TEAM

1. GOVERNMENTS AND RELATED INSTITUTES

- SECRETARIA DE INDUSTRIA Y COMERCIO EXTERIOR
- MINISTERIO DE INDUSTRIA Y COMERCIO
- GOBIERNO DE CORDOBA SECRETARIA DE CIENCIA Y TECNOLOGIA AVANZADA
- MINISTRO DE ECONMIA Y HACIENDA
- SUBSECRETARIA DE POLITICA Y PLANIFICACION, SECRETARIA DE CIENCIA Y TECNOLOGIA
- PRESIDENCIA DE LA NACION
- INDUSTRIAL, COMERCIAL Y INMOBILIARIA

2. INSTITUTES RELATED TO CERTIFICATION, INSPECTION AND QUALITY CONTROL

- INSTITUTO NACIONAL DE TECNOLOGIA INDUSTRIAL
- DEPARTMENTO DE FISICA DEL INTI
- CENTRO DE INVESTIGACION DE TEXTILE DEL INTI
- CENTRO DE INVESTIGACION TECNOLOGICA PARA LA INDUSTRIA PLASTICA DEL INTI
- CENTRO DE INVESTIGACION DE CELULOSA Y PAPEL DEL SISTEMA DE CENTROS DEL INTI
- CENTRO DE INVESTIGACION DE TECNOLOGIA ELECTRONICA E INFORMATICA DEL INTI
- INSTITUTO NACIONAL DE TECNOLOGIA INDUSTRIAL DEPARTAMENTO MECANICA DEL INTI
- COMISION NACIONAL DE ENERGIA ATOMICA
- MINISTERIO DE DEFENSA CITEFA
- COMISION DE INVESTIGACIONES CIENTIFFICAS DE LA PROVINCIA DE BUENOS AIRES
- CENTRO DE INVESTIGACIONES OPTICAS
- CENTRO DE INVESTIGACION Y DESARROLLO EN TECNOLOGIA DE PINTURAS
- LABORATORIO DE ENTRENAMIENTO MULTIDISCIPLINARIO PARA LA INVESTIGACION TECNOLOGICA
- INSTITUTO ARGENTINO DE RACIONALIZACION DE MATERIALES
- CAMARA DE INDUSTRIALES METALURGICOS DE CORDOBA
- SECRETARIA DE CIENCIA Y TECNOLOGIA AVANZADA
- CENTRO DE INVESTIGACION DE MATERIALES Y METROLOGIA DEL INTI
- REGISTRO DE CALIDAD CERTIFICADA
- SGS ARGENTINA S.A.
- LLOYD' REGISTER
- GAS DEL ESTADO
- OBRAS SANITARIAS DE LA NACION
- JUNTA NACIONAL DE CARNES
- JUNTA NACIONAL DE GRANOS
- ASOCIACION ARGENTINA DE CALIDAD Y CONFIABILIDAD
- SECRETARIA DE AGRICULTURA GANADERIA Y PESCA

- SERVICIO NACIONAL DE SANIDAD ANIMAL
- CAMARA DE AGENTES INDEPENDENTES DE INSPECCION DE LA REPUBLICA ARGENTINA
- SEROICIO ARGENTINO DE CALIBRACIONES
- COMITE DE DIRECCION DEL SERVICIO DE CALIDAD DE EXPORTACIONES
- COMISION PANAMERICANA DE NORMAS TECNICAS (PAN AMERICAN TECHNICAL STANDARDS COMMISSION)

3. AUTOMOTIVE ASSOCIATIONS AND AUTO-PARTS FIRMS

- CIFARA: Camara Industrial de Fabricantes de Autopiezas
- ADEFA: Asociacion de Fabricas de Automotores
- CCIA: Consejo Condinador de la Industria de Autopartes
- CAIA: Camara Argentina de la Industria de Autocomponentes
- WOBRON S.A
- SHUNKO S.A
- DEMA S.A
- FEBREMET S.A
- PESCARA S.A
- MAZZUCCO S.A
- RESORTES ARG. S.A
- VENTURI S.A
- PETRUZZI S.A
- TIFEC S.A
- TRANSAX S.A
- LIGGETT S.A
- GIACOMELLI S.A
- E.T.M.A S.A
- CLORINDO APPO S.R.L
- BASSO S.A
- R.G FRENOS S.A
- BONAFEDE S.A
- CIMETAL S.A
- FRIC ROT S.A
- ROHER S.A
- GAREF S.A
- ARGELITE S.A
- RALUX S.A
- IND. RAT S.A
- SICELA S.A

- BRD S.A
- INDUMAG S.A
- TEG S.A
- FITAM S.A
- KOVAL Y BLANCK S.A
- ESPEL S.A
- NASHVILLE S.A
- LO SCHIAVO Y BEVILACQUA S.A
- VERINO Y PAGLIERO S.R.L
- AUDIAN CORDOBA S.A
- CIBIE S.A
- VOLTACORD S.A
- ELECTROMECANICA GOSCA S.R.L
- BURMOR S.A
- SISTEMAIRE S.A
- LUCASIRDIEL S.A
- EATON S.A

4. OTHER RELATED INSTITUTES AND FIRMS

- YACIMIENTOS PETROLIFEROS FISCALES
- THE EXPORT-IMPORT BANK OF JAPAN BUENOS AIRES AIRES OFFICE
- KEYSOFT
- INFORMATICA INTEGRAL
- INSTITUTO DE INVESTIGACIONES CIENTIFICAS Y TECNICAS DE LAS FUERZAS ARMADAS
- COMISION NACIONAL DE ENERGIA ATOMICA
- JETRO BUENOS AIRES OFFICE
- BANK OF TOKYO BUENOS AIRES OFFICE
- SISECOM S.A.
- CAMARA DE EMPRESAS DE SOFTWARE
- CFENTRO DE INVESTIGACIONS OPTICAS
- UNION INDUSTRIAL ARGENTINA
- SOMOS
- UNIVERSIDAD DE BUENOS AIRES
- LIGA ACCION DEL CONSUMIDOR
- UNIVERSIDAD ARGENTINA DE LA EMPRESA
- CAMARA DE EMPRESAS DE INVESTIGACION DE MERCADO
- SIDERCA S.A.I.C.
- CONFEDERACION GENERAL DE LA INDUSTRIA DE LA REPUBLIC ARGENTINA
- IPSA ARGENTINA
- SEBER:

- WAR-CAR
- RECURSOS HUMANOS Y ORGANIZACION
- ESTABLECIMENTOS METALURGICOS ONCATIVO S.A.
- PANASONIC FUEGUINA S.A.
- BANCO NACIONAL DE DESARROLLO
- SANELCO S.A.(USUAHIA)
- PECOM-NEC
- INDEC
- BENCER S.A. (AURORA GRUNDING MAGICLICK)
- MITSUI O.S.K.LINES BUENOS AIRES OFFICE
- CAMARA ARGENTINA DE CONSTRUCTORES DE EMBARCACIONES
- SEVEL ARGENTINA S.A.
- LA CAMARA ARGENTINA DE LA INDUSTRIA PLASTICA
- CAMERA DE LA INDUSTRIA DEL NEUMATICO
- BAK-PLASTIC ITALO ARGENTINA
- THE DAI-ICHI KANGYO BANK BUENOS AIRES OFFICE
- AUTOLATINA ARGENTINA S.A.
- HONDA MOTOR DE ARGENTINA S.A.
- SOCIEDAD MIXTA SIDERURGIA ARGENTINA
- LINKOLAN S.A.I.C.
- ARGENCRAFT S.A.
- CAMERA ARGENTINA DE LA MAQUINA HERRAMIENTA
- VASA ARGENTINA S.A.
- CAMERA ARGENTINA DE FABRICANTES DE HERRAMIENTAS E INSTRUMENTOS DE MEDICION
- METALURGICA ROMA
- THE CHAMBER OF COMMERCE OF UNITED STATES ARGENTINE OFFICE
- CONFEDERACION GENERAL DEL TRABAJO
- UNIVERSIDAD TECHNOLOGICA NATIONAL

ATTACHMENT 11. ABBREVIATIONS

ADEFA	Asociacion de Fabricas de Automotores
AGD	Secretaria de Agricultura Ganaderia y Pesca
AOTS	The Association for Overseas Technical Scholarship
ASADECC	Asociacion Argentina de Calidad y Confiabilidad
ASQC	American Society for Quality Control
BONEX	Bono Externo
CAIA	Camara Angeutina de la Industria de Autocomponeutes
CAIDIRA	Camara de Agentes Independentes de Inspeccion de la Republica Argentina
CALEX	Comite de Direccion del Seroicio de Calidad de Exportciones
CCIA	Consejo Coodinador de la Industria de Autopartes
CGI	Confederacion General de la Industria de la Republica Argentina
CIC	Comision de Investigaciones Cientifficas de la Provincia de Buenos Aires
CICELPA	Centro de Investigacion de Celulosa y Papel del Sistema de Centros del INTI
CIDEPINT	Centro de Investigacion y Desarrollo en Tecnologia de Pinturas
CIFARA	Camara Industrial de Fabricautes de Autopiejas
CIMECO	Camara de Industriales Metalurgicos de Cordoba
CIMM	Centro de Investigacion de Materiales y Metrologia del INTI
CIOP	Centro de Investigaciones Opticas
CIT	Centro de Investigacion de Textile del INTI
CITEFA	Ministerio de Defensa Citefa
CITEI	Centro de Investigacion de Tecnologia Electronica e Informatica del INTI
CITIP	Centro de Investigacion Tecnologica Para la Industria Plastica INTI
CNEA	Comision Nacional de Energia Atomica
COPANT	Comision Panamericana de Normas Tecnicas(Pan American Technical Standards Commission)
CSE	Comision de Seguridad Electrica(Secrectaria de Comercio)
ENTel	Empresa Nacional de Telecomunicationes
FIEL	Fundacion de Investigaciones Economicas Latinoamericanas
FOPEX	Fondo Nacional de Promocion de Exportacion
GDP	Gross Domestic Product
GDS	Gas del Estado
GNP	Gross National Product
IACC	Instituto Argentino de Control de la Calidad
INDEC	Institute Nacional de Estadistica y Censos
INFLEX	INFLEX S.A.
INTI-FISICA	Departmento de Fisica del INTI
INTI-INTNL	Instituto Nacional de Tecnologia Industrial

INTI-MECANICA	Departamento Mecanica del INTI
IRAM	Instituto Argentino de Racionalizacion de Materiales
ITALAVIA	ITALAVIA S.A.CI.F.
JNC	Junta Nacional de Carnes
JNG	Junta Nacional de Granos
LEMIT	Laboratorio de Entrenamiento Multidisciplinario Para la Investigacion Tecnologica
LLOYDS	Lloyd' Register
MEH	Ministerio de Economia y Hacienda (FUEGO)
NA	Coordinador de Normalization (SICE)
NA	Norma Argentina
NADE	Nomeuclatura Arancelaria y Derechos de Exportacion
OSN	Obras Sanitarias de la Nacion
PRESIDENT	Directora General de Estudios y Paroyectos Secretaria General-Presidencia de la Nacion
PYME	Subsecretario Peguena y Mediana Empres a
RECACER	Registro de Calidad Certificada
RENAULT	Renault Argentina S.A.
SAC	Servicio Argentino de Calibraciones
SECyT	Secretaria de Ciencia y Tecnologia Avanzada
SENASA	Servicio Nacional de Sanidad Animal
SGS	SGS Argentina S.A.
SIC	Subsecretario Industria y Commercio
SICE	Secretario de Industria y Comercio Exterior
UBA	Universidad de Buenos Aires
UIA	Union Industrial Argentina
UOM	Union Obrero Metalurgica
UTN	Universidad Tecnologica Nacional
VA/VE	Value Analysis / Value Engineering
YPF	Yacimientos Petroliferos Fiscales Sociedad del Estado

JICA